Center for Business and Economic Research College of Business Administration The University of Tennessee, Knoxville

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BEGINNING THIS ISSUE:
ECONOMIC INDICATORS
FOR TENNESSEE

Survey

COMPUTER TECHNOLOGY IN THE BUSINESS SCHOOL: THE TENNESSEE EXPERIENCE

Survey
OF BUSINESS

C. Warren Neel, Dean
College of Business Administration

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Consulting Editor's Comments

Five years ago, the UTK College of Business Administration committed itself to a substantial investment in computer technology, resulting in the purchase of approximately 350 personal computers with related software and the direct connection of most of them to the University mainframe computers. The hardware and software purchases also necessitated an investment in personnel to provide assistance to faculty, staff, students, and administrators. Thus, the outlay required a concerted obligation on the part of all concerned. In the eyes of the dean, C. Warren Neel, the ultimate goal was "to use the computer to liberalize professional education in business; to foster both depth and breadth in research for student and faculty alike." He was particularly concerned that the University's MBA students be prepared for the realities of the business world, where the microcomputer revolution was changing the qualifications that leading corporations look for in new recruits.

Computer technology has also created the potential for proliferation of new publishing technologies, but in the midst of all these time- and money-saving breakthroughs is the issue of quality control. At a time when more control to assure quality may be needed, universities may have to invest more in technology to maintain a competitive position. Questions involving quality, integrity and professionalism all represent issues that are coming more and more to the forefront with the new technology. The time-saving and aesthetic benefits of the desktop publishing technology forces us also to examine our resulting responsibility and integrity. These are questions we need to address at The University of Tennessee, as other universities are doing all over the country.

In the first article in this issue of the *Survey*, Dean Neel and Max Cornelius review the history of the computer acquisition program, noting that technology acquisition was only the first step. More important was the problem of providing the support infrastructure. Addressing that issue has become an ongoing challenge. Next, Faye Borthick, Associate Professor of Accounting and Business Law, and James H. Scheiner, Professor of Accounting, discuss the impact of technology on the accounting curriculum. Then David M. Mandy, Assistant Professor of Economics and Research Assistant Professor at CBER, approaches the technology issue from the standpoint of the business research center.

In the next article, Michael C. Ehrhardt, Assistant Professor of Finance, examines the technology integration program from the viewpoint of its benefits for classroom teaching, specifically in the MBA finance courses. Finally, Ernest R. Cadotte, Professor of Marketing, describes a unique marketing game designed to provide students with appropriate experiences in business decisions.

I would also like to thank David A. Hake, Director of CBER, and Jeanne McDonald, Managing Editor, for their assistance in compiling this issue.

James H. Scheiner
Consulting Editor

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Technology in the Classroom: Are We Using it to Our Best Advantage? *by Michael C. Ehrhardt*	**15**	*Michael C. Ehrhardt is an assistant professor of finance, UTK. His research interest is in bond pricing.*
Filling the Gap in Business School Education *by Ernest R. Cadotte*	**20**	*Ernest R. Cadotte is a professor of marketing at UTK. His Market Place simulation game has become a model for real business situations.*

This issue initiates a new service for CBER. Henceforth each issue of the Survey will contain a discussion of coincident and leading indicators for Tennessee, accompanied by charts and tables.

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TECHNOLOGY IN THE COLLEGE OF BUSINESS: AN OVERVIEW

by C. Warren Neel
and Maxwell J. Cornelius

The rapid growth of microcomputers in the early 1980s changed forever the state of affairs in both the business world and business schools. Business education would never be the same.

Educating the next generation of leaders to use modern technology has been a particularly difficult task for most business schools in the country. The complexity of the technical issues is generally matched by budgetary complexity when equipment-intense instruction is introduced into business programs for the first time.

When the College of Business Administration at The University of Tennessee, Knoxville decided to invest in computer technology in 1982, historically the College had no real technology needs, and therefore, no money had been budgeted for equipment. Computer usage at that time reflected the state of affairs in the business world itself. A small subset of the faculty used the large mainframe computers on the campus, but the majority saw no need for a widespread College acquisition program.

The Changing Structure

The rapid growth of microcomputers in the early 1980s changed forever both the business world and business schools. Whereas before that time, only large companies were able to afford expensive mainframe systems, now small enterprises and individuals could afford computing power. Whereas before, only a few were willing to invest the considerable time and effort needed for mainframe programming, the new user-friendly software being offered for personal computers made usage a much less tedious and therefore much more attractive proposition for larger numbers of people. Business education would never be the same.

The new challenge is to encourage the optimum number of people to use the equipment in as many different and creative ways as possible without sacrificing our common purpose -- the delivery of a quality academic experience for all students.

As that realization dawned on us, it became obvious that CBA would not be fulfilling its mission if we failed to provide both training in microcomputer use and student exposure to the techniques of applying this affordable and powerful tool to solving problems in the various business disciplines.

At that point, we established a faculty technology committee to recommend directions for College computer activity. In 1982 twenty microcomputers were set up in a student lab and nine were placed in various academic departments.

In response to the favorable reception of this initial step, as well as to a growing awareness among our own faculty of the importance of the new technology in the continuation of a quality business education, we decided to accelerate our efforts. We then set about to define a new plan for technology integration.

Goal, Strategy, and Plan

We defined a goal: **To achieve the effective integration of modern computing and communications technology into the Business School curriculum at both the graduate and undergraduate levels.**

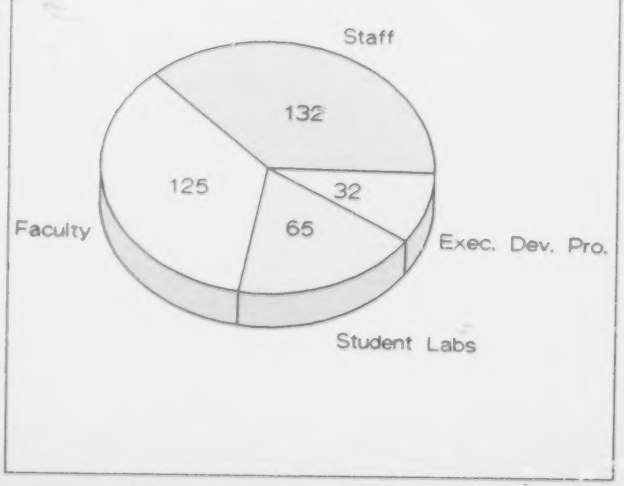
We formulated a strategy: **To provide every member of the College faculty, management, and staff with a personal computer and to enable appropriate access to technology for all students.**

We outlined a plan: **To invest 2 million dollars over the next three years (1985 through 1987) to launch us toward these goals.**

We now refer to the years 1985 through 1987 as Phase I of the CBA technology integration. Both monetary and pedagogical considerations made it mandatory that we adopt certain standards for both software and hardware. We had often witnessed at other institutions the "Tower of Babel" effect that derived from complete freedom of choice in purchasing.

We established early on the Computer Resources Group, a staff of computer professionals within the College, to support the acquisition, installation, and maintenance of equipment and the training of faculty and staff. In addition, about 350 workstations were installed in the College. (See Figure 1.)

FIGURE 1
Workstations Installed in CBA
1985 - 1987



Simultaneously, three microcomputer labs were set up, giving students access to 65 machines 12 to 14 hours a day. Seven communications boxes were purchased to provide "hardware" mainframe access for 265 of these microcomputer-based workstations.

Merely providing people with technology would not insure use. We realized that initial training and continued reinforcement would be required. With this philosophy in mind, the Computer Resources Group and a number of College faculty jointly developed a minicurriculum of specially targeted training classes on all the standard software packages. Hundreds of faculty, staff, and students have availed themselves of these materials during the past three years.

The ultimate goal of all of these efforts was to profoundly affect the College curriculum. To encourage the transfer of computer use from faculty desktops to classrooms, the Computer-Based Instructional Material (CBIM) program was established. This program provides release time and programming support for faculty to develop courseware materials. To date, seven projects have been funded in a number of areas.

Projects include grants in Marketing, Logistics and Transportation to develop modules, including marketing simulation and computer-produced materials for service logistics; and in the finance area, teaching modules–one in the area of employee benefits and the other in estate planning. Queueing model courseware was developed in the area of management science.

The New Challenge

Fiscal year 1987 marked the end of this first phase of technology integration. Phase II, which has already begun, is both a continuation of the established momentum and a time for reassessment and fine-tuning our plans. The focus of Phase I was strategic consistency. In Phase II the goal is strategic diversity.

The new challenge is to encourage the optimum number of people to use the equipment in as many different and creative ways as possible without

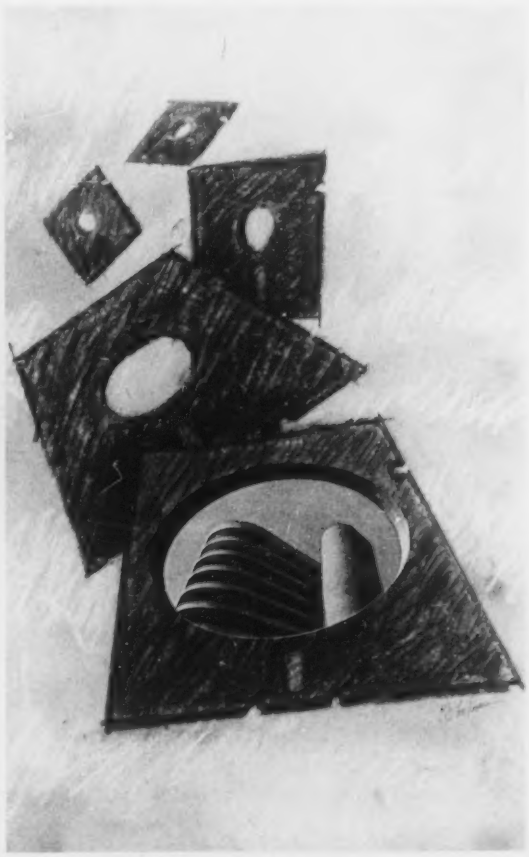
A major challenge for the College of Business Administration has been managing the budget of the College under the impact of its attempt to provide an ongoing infrastructure for technology. At CBA we have seen a dramatic increase in equipment costs, yet budgeted funds from the state for the acquisition and support of technology equipment have not been available.

sacrificing our common purpose --the delivery of a quality academic experience for all students.

A new faculty computer advisory committee has been established to constantly assess the status of technology integration and to recommend new technology goals for teaching and faculty research. This committee surveyed the College faculty in spring of 1988 to determine technology usage and needs in the College. The survey covered issues such as computer application use among faculty, hardware and software needs, teaching and research integration and electronic mail usage.

Certain directions are already evident for Phase Two. In the area of curriculum and faculty support, the following guidelines have been established:

- In the area of teaching support, we must continue the CBIM program with emphasis on a greater diversity of small course-ware projects. In addition, we must come up with ways to encourage and facilitate other courseware projects of less magnitude than those presently addressed by the CBIM program. We must also broaden the software and hardware standards.
- In the area of publication support we must upgrade the text processing capabilities of College workstations by acquiring up-to-date software and, where appropriate, to add graphics capability and the ability to integrate text and graphics.
- In the area of research support we must provide support for "appropriate computing" -- a balance of mainframe and microcomputer capabilities that will make the best of the strengths of each.
- In the area of hardware and software acquisition we must keep the college abreast of the rapidly evolving technology by replacing existing workstations over a five-year period.
- In the area of training we must provide training for smaller groups of people on a wider range of topics and, where appropriate, displace the more routine training tasks to other areas of the University.
- In the area of connectivity we must provide electronic networking in key areas within the College and be ready to connect to the evolving campus network when it seems appropriate.



Technology Infrastructure: The Future Challenge

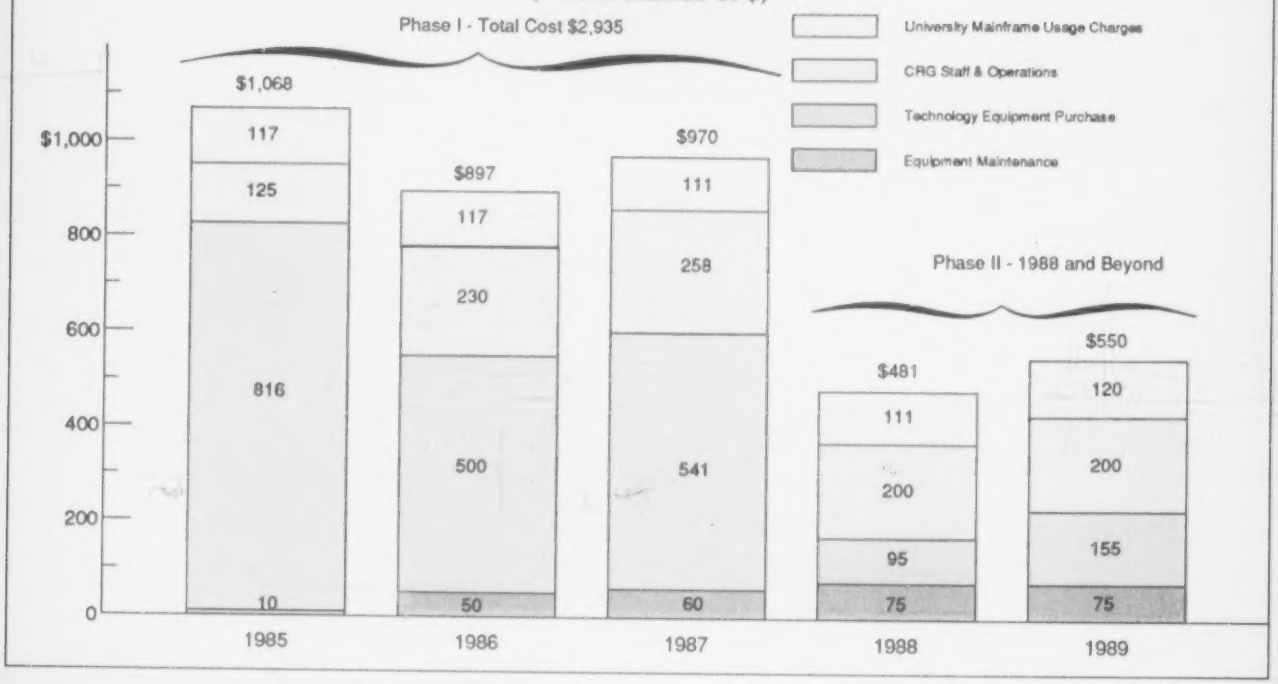
A major challenge for the College of Business Administration has been managing the budget of the College while attempting to provide an ongoing infrastructure for technology.

In many state-aided institutions around the country budgets are premised upon historical costs. Thus, sudden major changes in the cost construct, such as the addition of expensive technology, are not often reflected by a change in the original budget. At CBA we have seen a dramatic increase in equipment costs, yet budgeted funds from the state for the acquisition and support of technology equipment have not been available.

During the years of Phase I, (1985-87) the College spent $1,857,000* to acquire new equipment, about $50,000 of which came from state-appropriated funds. The total cost of technology in the College of Business Administration (microcomputer acquisition, mainframe usage costs, CRG staff and equipment maintenance) during Phase I was $2,935,000. (See Figure 2.)

**Sum of the technology equipment purchase component in Figure 2 from 1985-87.*

FIGURE 2
CBA Technology Costs
(In Thousands of $)



As we look forward to the future, we must plan to replace microcomputers in the College because of both wear and obsolescence. Table 1 shows the annual average cost of all computer technology in CBA simply to sustain current capacity. That annual cost is estimated to be $770,000. Each year that we are unable to achieve this level of technology expenditure, the College falls behind the levels attained during Phase I. The College spent $481,000 to maintain and support the level of computer activity in 1988, and $550,000 is estimated for 1989.

Any significant expansions to our capabilities will add to annual replacement, staffing and maintenance costs. A bond issue passed by the Tennessee legislature in 1988 will provide a modest amount of capital expenditure for additional computing and related equipment for the undergraduate academic programs. It will be the responsibility of the College to match those funds dollar for dollar as they are expended. The operating budget still presents a dilemma, however. The initial purchase by the College resulted in an ongoing operating bill of $395,000 (sum of last three items listed in Table 1). And additional capital expenditures, while much appreciated, still do not address the operating budget issue.

The College is extremely appreciative of what the state has done with regard to equipment. We are indeed fortunate to have an equipment purchase program funded by a bond issue: it is much needed and should result in further enhancement to the quality of undergraduate education. The dilemma that all of us in education face is that the expenditure of capital funds will necessarily result in an increased operating expenditure–for which no provision is made. How that dilemma will be handled will become an issue of increasing concern as the pressure of modern technology continues.

TABLE 1
Annual Average Estimated* Costs
for Phase II:1988 and beyond

Annual replacement cost for 5-year replacement cycle ($1,857,000÷5)	$375,000
Computer Resources Group staff and operating expenses (maintenance)	200,000
UTCC mainframe usage charges	120,000
Maintenance	75,000
TOTAL	$770,000

**Estimated to maintain current capacity and replace aging equipment.*

Building a quality educational experience for the leaders of tomorrow is dependent upon an equipment-intense education experience. Completing that transition will place more and more stress upon state budgets and other funding sources in order to support the ongoing use of the equipment purchased. Thus, after the initial investment and purchase, funding a maintenance program becomes an increasingly complex issue. □

COMPUTER TECHNOLOGY IN ACCOUNTING: PREPARATION FOR A CAREER

by A. Faye Borthick
and
James H. Scheiner

Through a course sequence requiring progressively more challenging computer-related assignments, accounting students are preparing themselves for a future in which their success in learning new information techniques will help determine career success.

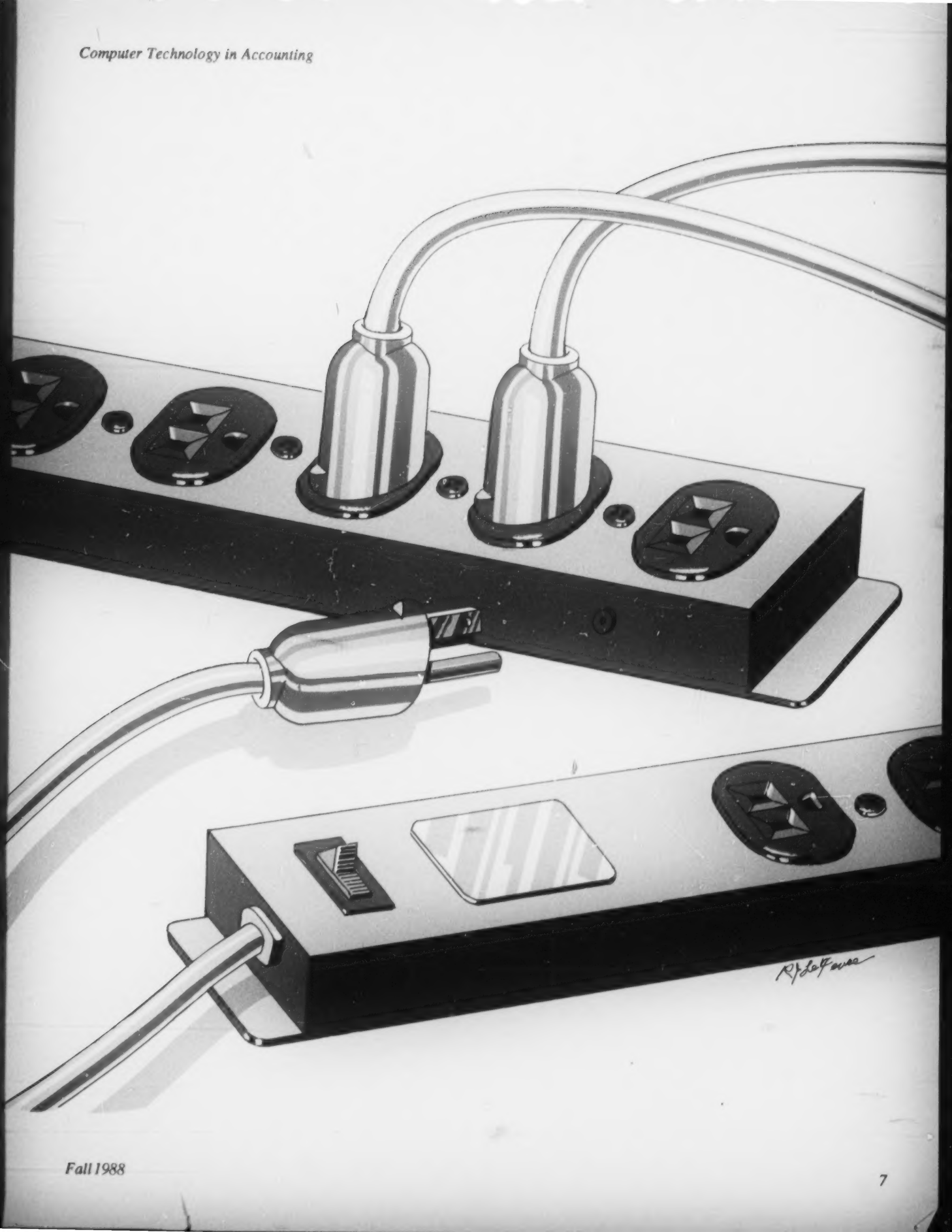
In today's technological society, accounting careers increasingly demand skill in using, creating, and evaluating accounting information systems. The recently restructured accounting curriculum at UTK prepares students for an increasingly information-dependent profession. Through a course sequence requiring progressively more challenging computer-related assignments, accounting students are preparing themselves for a future in which their success in learning to use new information techniques and tools will determine their career success.

A New Way of Life

At The University of Tennessee, Knoxville, accounting students are preparing themselves for careers in which information technology will be a crucial resource. Although accounting information has always been important, until recently no one thought much about accounting information in strategic terms. Now, however, accountants' ability to collect, aggregate, and analyze quantitative and qualitative information can make the difference between success or failure of enterprises.

Several environmental and technological trends, as identified in AAA [1987], have led to the growing importance of information technology in accountants' work:

- The decreasing cost of computer hardware makes it affordable enough to be available whenever and wherever accountants need it.



Technology is changing faster than professionals can readily keep up with it. Since obsolescence comes so quickly, the onus is on professionals and faculty alike to make the best use of critical resources--training facilities, trainers, and an assessment of training time.

The facilities of choice often involve microcomputers as stand-alone devices or terminals connected to other computers.

- The growing ease of use of software such as spreadsheets, accounting systems, database managers, and planning languages makes computing power accessible with less training.

- Increasing competition in global markets makes it imperative for organizations to perform to the best of their capabilities. Lack of information or the absence of careful analysis of prodigious amounts of data can easily lead to ruin.

- New demands have been placed on accounting and auditing as management asks accountants to do their part in helping organizations stay competitive and as society enlarges auditors' responsibilities, e.g., in the detection of fraud.

The net effect of these trends is to create an environment in which accountants must be proficient users, creators, and evaluators of accounting information or cease being accountants. For 15 years, accounting faculty at UTK have been national leaders in their use of computing technology in the curriculum. The faculty are maintaining their leadership by developing the accounting curriculum through innovative course materials that prepare students for careers in which using information technology is a way of life.

The Curriculum

One thing that is clear about the computer business is that the technology is changing faster than professionals can readily keep up with it. Since obsolescence comes so quickly, the onus is on professionals and faculty alike to make the best use of critical resources--training facilities, trainers, and an assessment of training time. Being cognizant of this reality, the accounting faculty took the opportunity of the semester transition which began in August 1988 to restructure the timing and sequence of computing instruction that accounting students receive.

The Courses

With respect to information technology, the guiding principles in the curriculum restructuring were designed to (1) give students the computing skills their future employers will be expecting them to have, and (2) be efficient in delivering training and creating progressively more challenging assignments requiring computer technology. Under the semester system, these goals yielded an accounting program with the following features related to information technology:

- *Introduction to Computer Science.* A freshman-level course in computer science to introduce students to preparing problem formulations that are amenable to solution by computer programs.

- *Introduction to MIS.* A junior-level business course introducing information system concepts and microcomputer tools (spreadsheet and database manager) germane to management information systems (MIS).

- *Financial and Managerial Accounting.* Junior-level courses in financial and managerial accounting in which students use the skills from the previous computer science and MIS

courses to solve problems in accounting.

- *Accounting Information Systems.* A junior-level accounting information systems course that builds on the computing skills developed in the MIS and managerial accounting courses. This course is devoted to the study of accounting information systems as a means of collecting, organizing, and distributing economic information about organizations. Through a series of progressively more challenging assignments, students develop the ability to learn how to use software tools to manipulate accounting information. The culmination of this course is a project in which groups of students develop their own accounting information system and present it to others.

- *Auditing, Taxation and Advanced Financial Accounting.* Senior- level courses in (1) auditing, (2) taxation, and (3) advanced financial accounting that feature real-world assignments requiring students to draw on the computing background they obtained in the junior-level accounting courses.

- *Accounting Masters.* Master's level accounting courses in auditing, financial and managerial accounting, systems, and taxation that require a computing background equivalent to that obtainable through the undergraduate accounting courses.

Computer Literacy in the Short Run

The ambitious curriculum described above has its costs, one of which is the need for remedial training for students who do not come into the junior-level accounting courses with the required level of computer literacy. Realizing that some students do not come to the university with homogeneous backgrounds in computing and hence would need help beyond that incorporated in the courses, the accounting faculty prepared self-help materials in the use of spreadsheets and database managers. Students who lack the expected level of computer literacy are required to use these materials to develop their competence within a few weeks of enrolling in the junior-level managerial and accounting information systems courses. Thus, even though students' grasp of the use of software tools is not homogeneous initially, there is a means of helping individual students acquire the needed skills.

Coopers & Lybrand Development Grants

During its restructuring of the semester curriculum, the Accounting Department was invited to participate in the Coopers & Lybrand Foundation Curriculum Development Program Grant for the purpose of developing computer-based case materials to be used in individual accounting courses.

With the help of the $20,000 grant received in 1987, five faculty members, Professors A. Faye Borthick, C. Douglass Izard, Imogene A. Posey, James M. Reeve, and James H. Scheiner, prepared computer-based cases in systems, taxation, managerial accounting, financial accounting, and auditing. Preparing computer-based cases is time consuming and without the Coopers & Lybrand grant the department would not have been able to make progress nearly as quickly in developing the needed course materials.

Specializing in Systems

UTK offers a Master of Accountancy (M.Acc.) degree with three choices of concentration: auditing/financial, systems, and taxation. Not only do the concentrations give students a specialized program of study, they also prepare them for specific career paths. The systems M.Acc. concentration is for students who want further grounding in accounting information systems to prepare themselves for careers in auditing, management accounting, or management consulting that require in-depth expertise in systems.

The systems concentration itself consists of four courses: database systems, systems analysis/audit and control systems issues and policies (including advanced technologies such as expert systems), and budgetary planning and control systems.

The M.Acc. systems students seek positions requiring varying combinations of use, management, design, development, enhancement, maintenance, training for, and audit of information systems. Some categories of positions are (1) auditor (computer, external, and internal), (2) consultant (management or systems, external or internal), (3) management accountant or budget or cost analyst, (4) systems analyst, integrator, liaisons/coordinators, and trainers/instructors. Employers of these students are (1) public and private companies, (2) governments, (3) accounting firms, and (4) consulting or other professional services.

Careers With A Future

One thing is sure: when it comes to technology, accountants in the future will be required to do things that have not yet been invented. Realizing this phenomenon, and considering the pace of advancing technology, the accounting faculty at UTK restructured the curriculum for the semester system with emphasis not focused on technology per se, but on learning methods of applying it in particular contexts.

It is true that students do learn to use specific software, but the overall approach is to inculcate how to solve accounting problems with the most advanced techniques and tools available so that UTK accounting graduates will be ready for the challenge of the not-too-distant future.□

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USING MICROCOMPUTER TECHNOLOGY AT CBER

by David M. Mandy

There must be fast, simple, and reliable methods of moving information from one data banking environment to another as well as to other computing applications within CBER. Integration is a foremost concern.

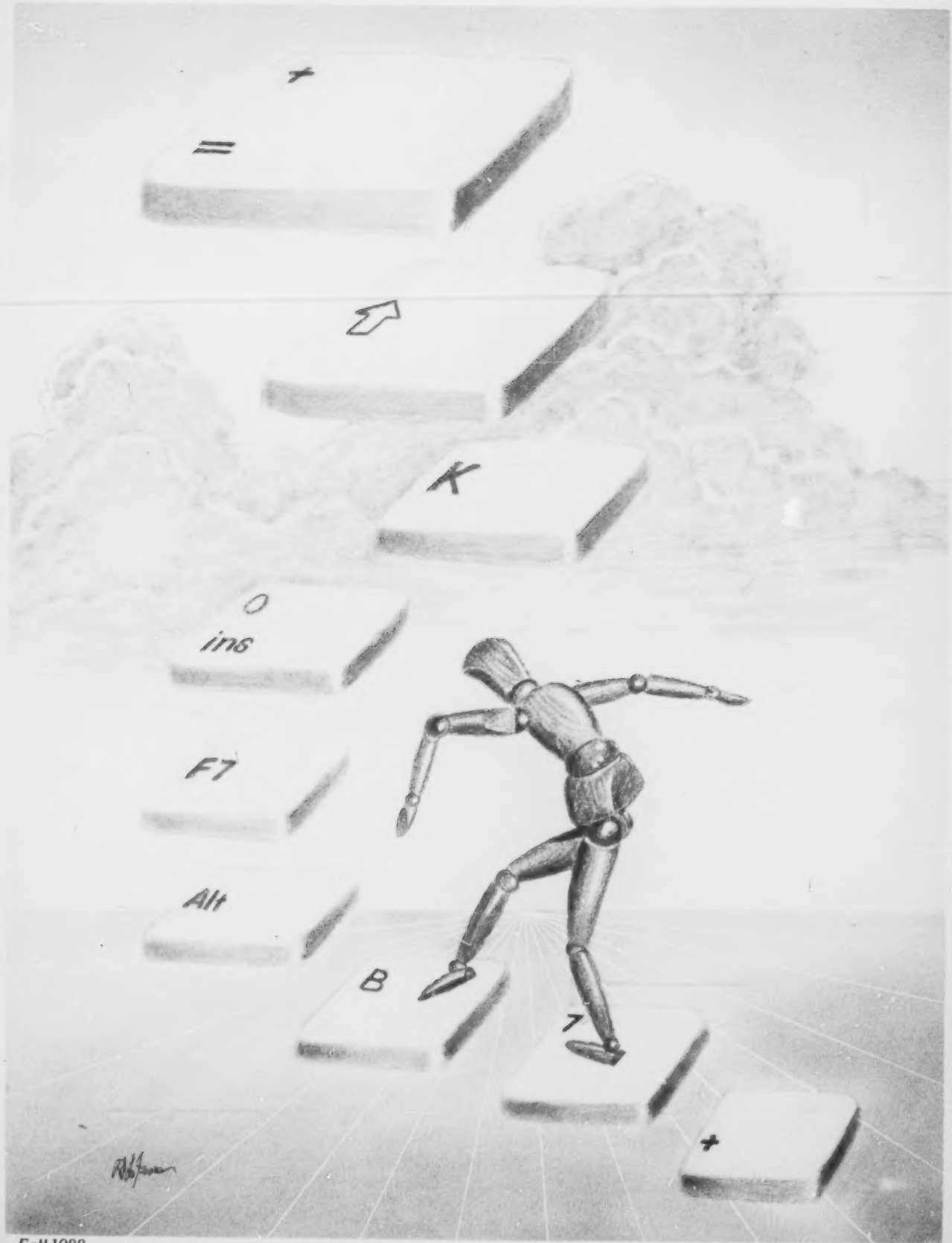
The advent of personal computing has radically altered both the set of tasks that are performed with computers and the manner in which those tasks are performed. At the Center for Business and Economic Research (CBER) at The University of Tennessee, Knoxville, personal computer technology is being utilized to the maximum, with new applications being studied everyday.

While the work performed at CBER is unique to a research organization, the computing problems are common, and the uses of microcomputer technology can be generalized to other environments. An overview of the technology applications at CBER can be divided into three major functional areas of computing: document processing, databanking, and research.

Document Processing

Three principal tasks are associated with document processing: word processing, graphics production, and document layout and formatting. Smooth and rapid document production requires the integration of these three tasks into a cohesive working unit. In CBER, each of these tasks has become more automated over time, but the integration of these tasks with computers is just now becoming a reality.

In the word processing arena, personal computers have revolutionized text production. Virtually all typing in CBER is done on computers, so that editing changes require only keyboard changes rather than retyping. On each iteration, documents appear in finished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Personal computing has addressed the heterogeneity at CBER by providing personalized computing solutions for different problems and users. Each problem can be addressed individually with a configuration of hardware and software customized for the job at hand and the preferences of the users.

form, no matter how many changes are made. This capability opens new opportunities for efficient use of time, from the researcher to the typist.

Other time-saving features include automatic footnote and bibliography maintenance, whereby reference numbers are adjusted automatically when entries are added or deleted, and each entry is properly positioned on the appropriate page. In addition, spell-checking and various other features are routinely utilized.

Graphics production has also changed dramatically with technology. With pen plotters, laser printers, and graphics software, virtually any style graph can be produced in-house at CBER with presentation quality. The time savings are enormous, and the time lag required to produce a graph is measured in minutes, instead of days. Graphs can be produced on paper in camera-ready form for documents destined for publication, slides or transparencies. With the integration of graphics with the databanking function of CBER's computers, the time savings are multiplied. Data can be readily transferred for graph production without being rekeyed.

Until recently, document layout and formatting was largely a manual job at CBER. However, with the advent of desktop publishing, document layout and formatting is becoming an automated task. Desktop publishing software now permits the integration of text and graphics on the same page electronically, so that camera-ready pages are produced on a laser printer with a minimum of cutting and pasting. Multiple-column magazine-style pages are formatted automatically, and multiple-type styles and fonts are all printed on one page. Hence, the need to subcontract the typesetting of headings, rule lines, and other special characters is eliminated, reducing turnaround time for publications. The layout of a publication is performed on-screen instead of manually, so that changes become a relatively simply matter, similar to the word processing environment. This affords further time savings and enhances the quality of the final product. Currently, at CBER entire documents are printed camera-ready with a laser printer using desktop publishing technology.* Since desktop publishing integrates text processing and graphics production, and graphics production is integrated with databanking, a final document can be produced with minimal duplication of effort.

*Since the winter of 1988, the entire issue of the Survey is produced in-house electronically, integrating all stages of production as described in the paragraph above.

Databanking

Building and maintaining data banks is an important aspect of many tasks performed at CBER. Research projects almost always rely on some type of databank. CBER also provides public access to economic data concerning Tennessee, and this function is by definition extremely data-intensive. For example, production of the annual *Tennessee Statistical Abstract* (Betty B. Vickers, editor) requires the maintenance of very large databanks. Databanks support the administration of CBER, as well. The common need among all of these databanking activities is simple, fast, and reliable data access and storage, and personal computing has significantly enhanced the ability to meet this need.

This common need is deceptively simple, due to the many ways in which data are used and the many types of data handled within CBER. Numeric data may consist of a time series or cross section of data, or both. Different frequencies and geographic coverages of time series may exist. Cross sectional data may be composed of a variety of cross sectional entities, perhaps at different levels of aggregation. Administrative databases are composed of both numeric and non-numeric data, like accounting information and personnel records. Other applications call for mailing lists or other non-numeric lists. If the data are used to support research, the databanking software must provide common arithmetic and statistical operations. Some of these same capabilities are needed for accounting data, while these capabilities may be useless or even cumbersome for a personnel database. Alternatively, other operations such as the ability to alphabetize may be extremely useful for non-numeric databases like personnel records and mailing lists, while being useless for a research database. Finally, certain operations are common to many different types of data, like the ability to select particular pieces of data by some predefined characteristic.

Personal computing has addressed this heterogeneity at CBER by providing personalized computing solutions for different problems and users. Each problem can be addressed individually with a configuration of hardware and software customized for the job at hand and the preferences of the users. A researcher can use databanking software that provides sophisticated data analysis tools, and hardware with a high degree of computational power. At the same time, an administrative assistant can use databanking software that provides easy manipulation of non-numeric information, and

hardware that produces high-quality printed output. In the personal computing environment, this diversification is possible because the cost of customized solutions is much lower than in alternative environments.

However, with diversification comes some costs. As optimal solutions are found to specific problems, it often becomes more difficult to integrate data from different sources. Hence, new requirements for databanking software and communications software and hardware are created in this environment. There must be fast, simple, and reliable methods of moving information from one databanking environment to another as well as to other computing applications within CBER. Integration is one of the foremost concerns within CBER since the introduction of microcomputer technology.

Research

Different types of research conducted at CBER require different computing capabilities: academic research of the sort regularly pursued in teaching departments, such as journal articles or presentations; one-time research projects for public and private agencies, such as contract completion reports; and ongoing projects that monitor various aspects of the Tennessee economy, such as the *Economic Report to the Governor*.

Academic research typically requires large amounts of data processing and storage and often utilizes unconventional statistical techniques. Hence, most of this type of research is still performed on mainframe computers. However, some projects that do not require mainframe facilities are using microcomputer technology, and as the power of these machines continues to increase, the trend is toward more use of microcomputers in academic research.

One-time research projects utilize a variety of computing capabilities, depending on the project. Some projects involve tremendous amounts of data and processing must necessarily be carried out on a mainframe system. For example, the recently released *Firm Entry and Exit: Economic Linkages in Tennessee* (John W. Mayo and Joseph E. Flynn) used a very large and complex database provided by the Tennessee Department of Employment Security and the databanking and analysis was carried out on a mainframe system.

Other projects are more amenable to the personal computing environment. For example, the report *An Evaluation of the Economic Impact of the University of Tennessee on the Knoxville Metropolitan Statistical Area: 1985-1986* (Matthew N. Murray) relied exclusively on microcomputers for data analysis and storage. Whenever capacity constraints of the computing system are not binding, the convenience and low cost of personal computers make them the preferred tool for this type of research.

Ongoing research projects at CBER rely more heavily on microcomputers. Short-term forecasts for the Tennessee economy are produced using the Quarterly Tennessee Econometric Model, the forecasts of which provide policy makers and businesses with information on the current status of the Tennessee economy and expected performance in the near future. A long-term view of the Tennessee economy is provided by the Annual Tennessee Econometric Model. Both types of forecasts are reviewed annually in *An Economic Report to the Governor of the State of Tennessee on the State's Economic Outlook*. Over the past two years, both forecasting models have been converted from mainframe operation to microcomputer operation. The results of this conversion have been increased speed and ease of operation with decreased costs. Most of the data underlying these models are now stored on personal computers, and a specialized software package is being utilized for both data storage and production of the forecasts. General monitoring of the state's economy and the tax receipts of state government is also conducted on microcomputers, with the advantage that the analysis can be carried out in Nashville or Knoxville, depending on where the researcher is located.

Two other models that have been recently converted from mainframe to microcomputer operation are the Tennessee Employment Security Insurance Forecasting Model (TESIM) and the Tennessee Industrial Location Impact Model (TILI). TESIM is utilized by the Tennessee Department of Employment Security, along with the quarterly economic forecast for Tennessee, to monitor and forecast variables associated with the unemployment insurance trust fund. This model uses the same specialized software as the statewide forecasting models in addition to some custom programming designed to capture certain institutional aspects of the unemployment insurance system. One advantage of using personal computing for TESIM is the ability to locate the model in Nashville, where it is most useful for the Department of Employment Security, instead of having the model reside on a mainframe computer in Knoxville.

TILI, a model used to simulate the impact of new industrial locations in Tennessee, estimates the myriad effects such a location may produce and provides estimates of revenues and costs for local government units and city and county school districts. The mainframe version of this model was used to estimate the impact of the Saturn location in Smyrna, Tennessee. By utilizing microcomputer technology for TILI, the model is more readily available to users across the state. A unique aspect of both of these models is the ability to simulate changes in the current environment and to conduct "what-if" experiments.

Problems Associated with new Computer Technology

Microcomputing has created for CBER a new set of problems, that were largely addressed by the University Computing Center before the wide-scale integration of this new technology. The level of expertise needed to successfully operate a personal computer is different from the level needed to operate in a mainframe environment. Reliability is also a more direct consideration than it was in the past. There

is also the problem of integrating the variety of hardware and software that exists in the personal computing environment.

Training needs are also affected in several ways by the integration of microcomputers into CBER. As the number of software packages expands, each user is required to spend more time learning to use the available tools. However, microcomputer software is often more user-friendly than mainframe software, which somewhat offsets the extra training time. Personal computing also requires each individual to become a systems analyst, to varying degrees, since the mundane aspects of keeping the system hardware and software operating are no longer handled by a staff of experts. Costs associated with training and systems operation can be partially controlled by creating local experts within the organization, and this approach is used in some cases within CBER.

Reliability is a major issue created by the move to microcomputers in CBER. In mainframe environments, hardware and software reliability is handled by a computing center. However, a breakdown of hardware or software tends to be more costly in the personal computing environment, and the solution to the problem must be sought locally. One partial solution is the use of periodic backups to minimize the impact of a disk failure or a software bug that destroys data.

Compatibility of the variety of hardware and software that inevitably emerges in a personal computing environment is a continual problem. Software packages do not always support the peripherals being used, and software often stores data in a unique format that is not accessible by other software.

Hence, formats must be found that multiple software packages can understand. This may require the translation of data across several formats when transferring data from one package to another. Also, hardware components are not always compatible, and care must be taken when acquiring both hardware and software to assure that the various components will work together. Networking is one solution available to enhance the integration of hardware and software, and is currently being pursued at CBER. However, networking itself requires some expertise, thereby adding to the already high training costs associated with personal computing environments.

Summary

Personal computing has enhanced productivity at CBER in many ways. The time savings and convenience associated with customized solutions to computing problems are significant. These advantages have filtered throughout the organization and have affected many tasks that are performed on a daily basis. The document processing, data banking, and research activities of CBER have all changed dramatically since the introduction of microcomputers. However, along with these advantages have come some costs. Training, software and hardware reliability, and compatibility are significant areas that require continuous attention to insure data integrity and quality publications.□

TECHNOLOGY IN THE CLASSROOM: ARE WE USING IT TO OUR BEST ADVANTAGE?

by Michael C. Ehrhardt

Although we take for granted applications that were unimagined even 20 years ago, there still exists one area that is relatively unchanged by technology: college education.

Ours is the most technologically advanced society on earth. Almost daily, research laboratories announce break-throughs in fields ranging from telecommunications to gene-splicing to superconductivity. Not only are our scientists and physicists pushing back the frontiers of knowledge, but engineers and technicians are also developing applications that pervade every aspect of our lives.

Although we take for granted applications that were unimagined even 20 years ago, there still exists one area that is relatively unchanged by technology: college education. When compared with the abundance of technological applications in our everyday lives, the lack of applications in education is startling. Three factors explain why technology has made few inroads into university education: the limited types of technological developments, the limited nature of many academic disciplines, and the limited training of university faculty.

Many technological developments are not particularly adaptable to education because they were originally designed for manufacturing or military applications. Unlike many previous technological breakthroughs, however, the microcomputer offers enormous potential for educational uses.

Although computers have been available for over two decades, they have not been widely integrated into the pedagogy of most academic disciplines, partly because they do not seem appropriate for some fields.

Curricula in which the potential for computer use is greatest are those disciplines that (1) are based

Any use of the microcomputer in the educational process is by definition an "integration of technology." Applications by the professor usually improve the existing process, while applications by the students have the potential for creating a fundamental difference in the way learning takes place.

on understanding concepts and not on memorizing facts; (2) deal with difficult analytical problems that require extensive calculations; and (3) require graduates to use computers on the job.

A major obstacle to the implementation of technology in modern education is the type of training received by most university faculty. They are schooled extensively in a particular scholastic discipline, with virtually no attention given to the art of teaching. In fact, most faculty tend to perpetuate the teaching models they saw as students, perhaps because there are few incentives to change the model. Peer approval and lucrative consulting opportunities come from research, not from innovative teaching. Therefore, it is no surprise that even creative and dynamic scholars are not breaking new ground with respect to teaching methodology.

Integration of Technology

The College of Business Administration at The University of Tennesse, Knoxville, has a unique opportunity to dramatically enhance the quality of education our students receive by integrating technology into the classroom. We have acquired the right technology--microcomputers, for our faculty and students. Our curriculum--business education, is ideally suited for the use of microcomputers. The mastery of complex concepts is required, analytical problems must be solved, and computers are used extensively by graduates on the job. Finally, and most importantly, the members of our faculty are committed to providing the best possible education for our students.

Strictly speaking, any use of the microcomputer in the educational process is by definition an "integration of technology." Most uses can be divided into applications by the professor and applications by the students. Applications by the professor usually improve the existing process, while applications by the students have the potential for creating a fundamental difference in the way learning takes place.

Improving the Existing Model

There are many ways in which the microcomputer improves the old process. It can be used as a word-processor to prepare a comprehensive course outline that contains definitions, equations, graphs, and tables that complement and reinforce the concepts in the textbook. Because this outline is saved in a file, it can be easily updated. In addition, the professor can make copies of these files available to students so that during class, the students can concentrate on thinking rather than copying.

The microcomputer can also be used to prepare complex graphics, which can be transferred to transparencies and used with an overhead projector. In fact, it is now possible to bring the computer to class and project the computer image onto a large screen that can be viewed by the entire class.

Although these applications make the old process more efficient and improve the effectiveness of the lecture, the fundamental model of education is unchanged.

A New Model: Learning by Discovery

Consider the problem of teaching someone to perform a new task. When the teaching consists of only verbal instructions and a demonstration of the task, tests show that the ability of students to correctly execute the task is relatively low and drops rapidly as the time between the demonstration and the test increases. When students are allowed to interact with the teacher by asking questions, both the level of performance and the length of retention increase. When students are guided through one repetition of the task, the subsequent level of performance and length of retention are dramatically higher.

This suggests something about how we learn. We are by nature inquisitive creatures and learn best when learning represents an act of discovery, i.e., when learning is a hands-on-experience. The microcomputer is capable of transforming conventional learning into such an act of discovery; the benefits are greater understanding and greater retention.

Learning by an act of discovery is actually a consequence of asking and answering a what-if question. For example, Copernicus asked, "What if the sun, and not the earth is at the center of our system?" Einstein asked, "What if time is relative but the speed of light is always constant?" Their answers, of course, have had an enormous impact on our lives.

One type of programming language that is extremely well suited for answering such what-if questions is "spreadsheet software," first used for spreadsheet applications in accounting.

With a spreadsheet program, it is quite easy to change a projected financial statement to answer "what-if" types of questions. For example, suppose you had originally prepared an income statement based upon a growth rate in sales of 10%, but wished to see the impact of a growth rate of 8%. Without a spreadsheet program, it would be necessary to recalculate the entire page by hand. With a spreadsheet program, only one number, the growth rate, must be changed; the program automatically updates every other number on the page.

Spreadsheet software packages offer many additional features. They can create tables, graphs, charts, and can actually do many statistical operations. However, it

is the ability to make a change and to instantly see the effect that makes them such a powerful learning tool; they are ideally suited for learning by discovery.

APPLICATIONS IN FINANCE

Following is a description of different projects required of MBA Finance students in my classes.

The Effects of Diversification

I provide students with a spreadsheet program in which the students can pick a portfolio of stocks. The program graphs the return on that portfolio, versus the return on the overall stock market. By varying the number of stocks in the portfolio, the students can instantly discover the effect of diversification.

Figure 1 shows the relationship when there is only one stock in the portfolio, and Figure 2 shows the effect of 20 stocks. It is fairly clear that as the number of stocks increase, the dispersion around the line decreases, vividly illustrating the reduction in risk caused by diversification. I could simply have shown the students a series of such graphs, but the act of discovery by the students greatly increases the learning effect and enriches the learning experience.

Black-Scholes Option Pricing Model

The price of a stock call option is determined by five variables: the time to maturity, the exercise price, the volatility of the stock, the risk free interest rate, and the price of the stock. In another spreadsheet program, the students can choose values for the variables and see the relationship between the value of the call option and the stock price, as shown in Figure 3.

Figure 4 shows this relationship when the student decreases the time to maturity. The students are able to discover for themselves the effects of changes in the inputs, and thus gain a deeper understanding and retention of the model.

ACRS vs. Straight-line Depreciation

The students are provided with a spreadsheet program which evaluates a project; the economic worth of the project is measured by the net present value of the cash flows. The project is initially set up with the Accelerated Cost Recovery System (ACRS) of depreciation. The students are asked to find a situation in which straight line depreciation is superior to ACRS; they were allowed to vary either the sales level or the effective tax rate. In general, straight line is inferior to ACRS unless there is no value to the tax shield in the early years of a project, the

FIGURE 1
Capital Asset Pricing Model

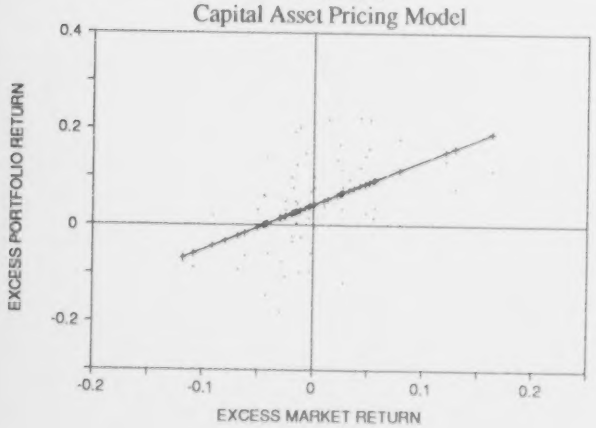


FIGURE 2
Capital Asset Pricing Model

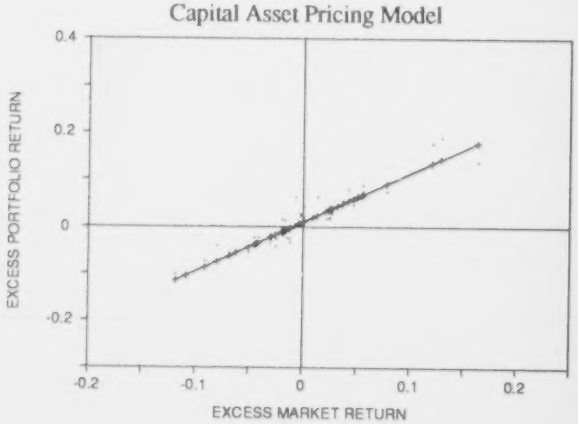


FIGURE 3
Plot of Call Price

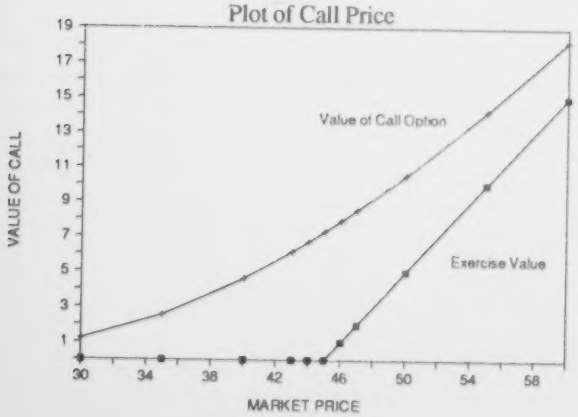
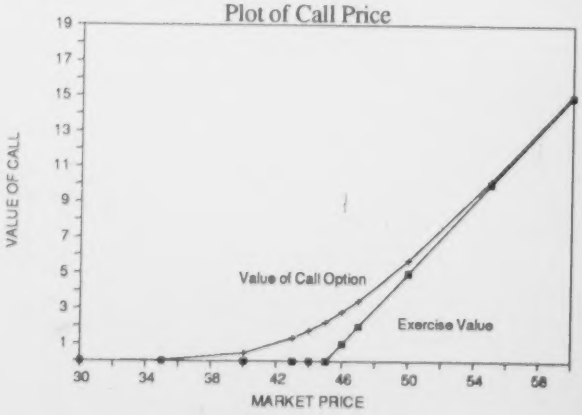


FIGURE 4
Plot of Call Price



We are by nature inquisitive creatures and learn best when learning represents an act of discovery, i.e., when learning is a hands-on-experience. The microcomputer is capable of transforming conventional learning into such an act of discovery; the benefits are greater understanding and greater retention.

result of either no income to shelter or no overall corporate tax liability. Using computer programming, the students were able to discover these conditions for themselves, gaining a deeper appreciation for the choice of depreciation method.

Common Applications

The previous examples required almost no knowledge of spreadsheet language, but for many other applications the students are required to create a spreadsheet program, necessitating that they fully understand the underlying theory as well as develop proficiency with the computer.

A simple exercise is for students to create a spreadsheet program for a car payment loan. The students are required to show the payment and actual interest in each month, based upon the typical method of interest allocation used in car loans. They are surprised to see that the effective interest is quite high at the beginning of a loan and that the principal is paid off more slowly than might be expected; thus, there is a disincentive for selling the car prior to paying off the loan.

Another relevant problem for most students is to construct a spreadsheet program for a student loan. They are required to show the payment number, the amount of the payment, the interest and principal paid in each period, and the remaining balance. They are also required to show the effect of accelerating payments in the form of making additional principal payments in each period. Most students are surprised to see that even small additional payments in the early period of the loan greatly reduce the time required to pay off the loan.

Gordon's Dividend Growth Model

One of the fundamental ideas in finance is that a stock's price is the present value of all future dividends. To find a stock's price, you must specify the future payments, pick the right interest rate to discount the future payments, find the present value of each payment, and add them together. There is an immediate difficulty inherent in applying the theory: if you assume that the company is going to stay in business, how do you specify an infinite stream of dividends? One way is to assume that dividends will grow at a constant rate. In this case, Gordon's dividend growth model provides a simple formula to calculate the price of a stock.

It is usually unrealistic, however, to assume that the growth rate will be constant forever. For example, some companies have a current growth rate in dividends that is phenomenal, but they are unlikely to sustain it forever. At some point the growth rate will decline to a long-term steady state rate. Students are required to create a spreadsheet program that allows the current (and observable growth rate) to decline over a period of years to the long-term steady state rate. By programming such a multi-stage model, the students will fully understand the underlying logic of the model. By varying the growth rates and discount factors, the students also gain an appreciation for the sensitivity of the model to the inputs.

Financial Statement Analysis

Before computers, the analysis of financial statements was a veritable nightmare of number crunching. Simply recording for one company the necessary data for a meaningful number of years was incredibly time-consuming; gathering data for a group of competitors compounded the problem. The analysis of the statements was even more time-consuming: creating common size and trended statements required an inordinate number of calculations, and computing ratios for each company in each period was equally labor-intensive.

Computers and data bases eliminated these problems. The financial statements for all companies in the Standard and Poore 500 are contained on diskettes, making them easily accessible by microcomputers. Students are required to select several companies and have the microcomputer retrieve their financial statements for the last ten years. They create common size statements, trended statements, and ratios for each company in each year. The entire process takes about fifteen minutes.

Capital Budgeting

The final project is one in capital budgeting. Students are given an unstructured problem: whether or not to acquire a proposed project. They are required to make necessary assumptions, create a spreadsheet program to analyze the project, perform sensitivity analysis, and make a recommendation. In many ways, this problem is similar to ones our students will face in their future careers.

SUMMARY

Only four years ago, the College of Business had very little technology for either the faculty or students. We recognized, however, that microcomputers used in a business curriculum offer the potential for improving the model of learning and for better preparing our students for their careers. In response to this opportunity, we have acquired microcomputers for all faculty members, installed extensive microcomputer lab facilities for students, and developed the capability of using microcomputers in the classroom itself. However, the acquisition of hardware and software was only the first step. More important and more difficult is the task of making this technology a fundamental part of our curriculum and making a commitment to explore the full potential of electronic applications in the University curriculum.□

FILLING THE GAP IN BUSINESS SCHOOL EDUCATION

by Ernest R. Cadotte

Business school critics assert that we place too much emphasis on quantitative analysis, "tools" and models and too little on qualitative thinking, complex tradeoffs, and creativity. Simulations like the Market Place represent the most advanced step in placing students in realistic business decision making situations..

Are business schools doing their jobs? A special report in the *Harvard Business Review* by Behrman and Levin (1984) suggests that we are not. According to the authors, business school critics assert that we place too much emphasis on quantitative analysis, "tools" and models and too little on qualitative thinking, complex tradeoffs, and creativity; too much emphasis on theory and not enough on execution; too much emphasis on short-term performance and not enough on long-term success; too much emphasis on bureaucratic management and very little on entrepreneurial activities and risk taking; too much emphasis on career and corporate goals and too little attention to interpersonal relationships and social ethics; and finally, too much emphasis on separate disciplines and not enough on integrative problem solving and management.

Part of that criticism stems from our primary method of teaching--by lectures and multiple choice exams. This format is very efficient for communicating a large number of concepts to a large number of students. But it does not encourage creativity, integration, problem solving, decision making, risk taking, or interpersonal skills.

Case analysis is proving to be a major step in encouraging those qualities in that, through case analysis, students are able to analyze and solve complex problems, think in strategic ways, and integrate material across disciplines. Its major drawback is that the students do not have to execute their decisions and live with the consequences. Nor are they required to respond to

The Market Place is designed to give students *practice* in the design, implementation, and control of marketing and business strategies. It is an operationally oriented exercise in which the *application*, and not the definition, of marketing concepts, principles, and methods is important. In addition, the *integration* of the major decision areas of marketing and business is stressed rather than the sequential presentation of these subjects.

competitive moves and counter moves or to deal with the nearly independent decisions of channel partners.

Simulations like the Market Place represent the most advanced step in placing students in realistic business decision making situations. Students can be placed in a dynamic business environment where execution and market responsiveness are just as important as analysis and planning.

During the past three years, the College of Business Administration at The University of Tennessee, Knoxville has supported the development of a business simulation entitled the Market Place. With the assistance of Carol Lammers, Pam Bridgman of the CRG, and Lillian Mason (now with IBM), the Market Place was designed to take full advantage of the recent developments in microcomputers and business software. As a result, the number and scope of decisions vastly exceeds any available marketing simulation. Furthermore, utilizing the program helps students to develop the very skills which Behrman and Levin emphasized as having been previously neglected.

Most marketing games are strategic in their focus: decisions are made at the senior management level and are primarily global in nature. The details of executing a strategic move (i.e., the repositioning of a brand on the price/performance continuum) are assumed to be carried out by lower management. In the Market Place, students must make middle-management-type decisions and get involved with tactical issues. It is a tactical game which can become strategic if one masters the use of the tactics.

The Market Place captures the qualitative and quantitative dimensions of marketing decision making within the context of a total business enterprise. Students have the opportunity to work as entrepreneurs. They must survey their markets, identify and evaluate market opportunities, design and execute a marketing program, monitor their own performance and that of their competition, and adjust their strategy and tactics as necessary. All decisions are constrained by limited financial resources; thus, cash flow management is critical to success.

Role of The Game in a Course

The Market Place is designed to give students *practice* in the design, implementation, and control of marketing and business strategies. It is an operationally oriented exercise in which the *application*, and not the definition, of marketing concepts, principles, and methods is important. In addition, the *integration* of the major decision areas of marketing and business is stressed rather than the sequential presentation of these subjects.

The Market Place is sufficiently comprehensive and integrative for an entire course to revolve around it. It can be suitable for a capstone marketing strategy course, a business policy course, or a new venture management course as either the undergraduate or graduate level.

The instructor's role in using the Market Place departs from the traditional format. Although lectures on marketing strategy, competitive analysis, or channel management may be warranted, the instructor's major responsibility is to serve as the chief executive officer who keeps the executive team pointed in the right direction. During regularly scheduled executive briefings, the team presents its analysis of the market, and announces the decisions which it has made and their justification as well as the team's plans for the future. The instructor's role is not to provide solutions to the team's problems, but to raise questions and issues which have not been addressed by the executive team.

Business Setting

The setting for the game is the microcomputer market. The industry structure includes manufacturers, distributors, and business and industrial users. Manufacturers design and produce microcomputers. Distributors purchase these microcomputers from the manufacturers and resell them to end users. (Other industry marketing scenarios are under development, including for 35 mm cameras and stereo rack systems.)

The market is composed of 20 metropolitan areas, representing the 20 largest markets in the U.S. The market is also divided into five major market segments which are differentiated according to the relative importance of price versus

performance. The segments include innovators, high-performance seekers, middle-of-the-road users, narrow-line specialists, and price-sensitive buyers.

Each segment has its own set of needs and wants. That is, each segment wants different features in the products it buys, responds to different advertising messages, and is selective in the media it reads or watches. In addition, the size of each segment varies by geographic area. Marketing research must be conducted to ascertain the needs, media profile and buying patterns by segment and geographic area.

Several factors determine the rate at which potential customers become active buyers in a city. Demand in any quarter is determined by (1) the city's sales potential, (2) the seasonal and economic conditions of the country as a whole, (3) the number and size of the stores in the city, (4) the number and quality of the brands carried by distributors, (5) the prevailing prices, and (6) the quality and volume of advertising directed at potential customers.

Manufacturer Decisions. A manufacturer's ability to capture the available sales in any metropolitan area is determined by the magnitude and effectiveness of its marketing efforts relative to its competitors. Specific areas under manufacturer control include (1) brand design (they must select from 30 possible components); (2) advertising copy design (they must choose and rank order up to 20 possible benefits); (3) media placement (11 different media are available); and (4) brand pricing. Marketing decisions are influenced by decisions in other areas of the firm, including (1) plant capacity, (2) production volumes, (3) inventory control, (4) research and development (up to five new features may be added after sufficient R&D expenditure), and (5) cashflow and financial management.

Under the manufacturer's influence through negotiations (but not their control), are a host of distributor decisions relating to (1) brand selection and placement, (2) brand pricing, (3) sales force allocation, and (4) media planning. To help in decision making, manufacturers may also buy market information relative to (1) customer needs, buying intentions and media preferences; (2) customer impressions of their advertising copy and brand design; (3) competitor and distributor decisions; and (4) brand demand by segment by city.

Distributor Decisions. Distributor success is also determined by the magnitude and effectiveness of its marketing efforts relative to competition. Specific areas under distributor control include (1) store location, (2) brand placement, (3) brand pricing, (4) sales force allocation, and (5) media planning. In addition, their marketing decisions are influenced by their decisions in other areas of the firm, including (1) inventory control, (2) marketing research, and (3) cash flow and financial management. Under distributor influence through negotiations, (but not under their control), are a host of manufacturer decisions relating to (1) brand design, (2) brand availability, (3) wholesale pricing, and (4) media planning. Distributors may also buy market information in order to obtain feedback on their decisions and those of their competitors and channel partners.

A major distinction between the Market Place and other marketing games is the inclusion of two levels in the channel of distribution. Most marketing games are designed from the perspective of the manufacturer. Moreover, the channel decision is often portrayed as a simple decision involving choice of the type of retail outlet or the number of sales people.

In the Market Place, the channel is composed of manufacturers and distributors. Manufacturers have the primary responsibility of designing and manufacturing a product and distributors have the primary responsibility of opening and stocking retail stores. For each party to succeed economic exchange is required. Thus, manufacturers and distributors must learn to negotiate. Short-term, self-serving tactics will result in alienation in the channel. Success comes from persuasion and the ability to give and take in channel negotiations.

Play of the Game

Essentially, the Market Place will allow the instructor to place students in business for eight to twelve quarters of play. As in most new ventures, they must start from scratch, with very little knowledge of the market. However, the play of the game is structured to help them move along the learning curve. (See Table 1). The students move into the market slowly by conducting a market survey (quarter 1), developing a preliminary strategy (quarter 2) and then test marketing and revising that strategy for two quarters (quarters 3 and 4). Students are financially constrained from expanding too quickly until they develop a feel for the market.

At the end of the fourth quarter or the first year of business, the students prepare a two-year business plan and submit a request for additional capital funding. In the business plan, they review their market analysis and market testing and develop a national "roll-out" strategy. This plan must include the sequencing and timing of events to achieve a final national presence at the end of either the eighth or twelfth quarter.

The last four to eight quarters of play provide the team with the opportunity to execute their national campaign and achieve national market penetration. The students' final success (measured in final retained earnings) depends on how well the team members conceived their strategy, how the market and competition reacted to the strategy, and the team's ability to make wise and timely adjustments to it.

Key Components of the Market Place

Figure 1 portrays the key components of the Market Place. They include a manufacturer decision template, a distributor decision template, a parameter set-up program, a demand generator, and a market research module.

A unique feature of the Market Place is that the students record their decisions on a Lotus 1-2-3 template. Most students are quick to learn how to use the decision template because it is strictly menu-driven, and almost all decisions require a fill-in-the-blank entry. The students' decisions are transferred electronically to the demand generator.

Manufacturers and distributors are also linked together through the exchange of data files. As Figure 1 indicates, brand inventory flows from the manufacturer to the distributor, and cash flows in the opposite direction. This exchange occurs during the negotiation process and is carried out by the execution of contracts.

TABLE 1
PLAY OF THE GAME

Manufacturer		Distributor
Design market survey	Q1	Design market survey
MOA Design 2 brands Build plant Start production Invest in R&D	Q2	MOA Open 2 stores Evaluate brands
Design ad copy Develop media budget Negotiate contracts Sell inventory	Q3	Design ad copy Develop media budget Negotiate contracts Buy inventory Make store decision Brand selection Shelf location Retail price Sales staff Inventory allocation POP displays
Budget mkt. research Design 2 brands Produce brands Invest in R&D		Budget mkt. research Open 2 stores Sell to end user
Evaluate research MOA Market appeal Competition Design ad copy Develop media budget Negotiate contracts Sell inventory	Q4	Evaluate research MOA Market appeal Competition Design ad copy Develop media budget Negotiate contracts Buy inventory Make store decisions Brand selection Shelf location Retail price Sales staff Inventory allocation POP displays
Budget mkt. research Design new brands Expand capacity Produce brands Invest in R&D		Budget mkt. research Open new stores Sell to end user

Note: Q = quarter
MOA = market opportunity analysis

The parameter set-up program (PSUP) specifies the unique characteristics of the microcomputer market place (or any other industry being modeled). The key parameters of all important equations within the demand generator are set up as variables and are read in from PSUP. PSUP is a user-friendly, menu-driven, Lotus program designed to facilitate the modification of demand generator equations.

The demand generator is a mathematical computer program designed to emulate the real market place for microcomputers based upon the parameters specified in PSUP. The primary role of the demand generator is to allocate demand among the various market offerings. Although the computations are very complex, the basic algorithm or procedure is fairly simple. Basically, the demand generator reviews every decision that each team makes and assigns points to them based upon their relevance to the market.

For example, if a manufacturer chose a brand feature which is of great value to the high performance segment, it would receive a large number of points from that segment. The same component might be of limited valued to the cost-cutter segment, where it would receive substantially fewer points. If a brand has distributor sales force support, a good shelf location and a POP display, then it will accumulate points across segments.

The objective is to accumulate as many points as possible for each brand. The computer will then compare the number of points a brand has accumulated to the number accumulated by competing brands. Demand will then be allocated among the available brands, based upon the appeal (points) of each brand. It is important to note that different segments will place different weights (points) on each decision they make. As a result, a marketing plan which has been designed for one segment may have little appeal to another segment.

After demand has been computed by brand and by market area, demand is deducted from the available inventory of each distributor and the appropriate cash is added to the balance sheet. This is accomplished by transferring the demand files from the demand generator and then updating the decision templates to the next quarter of play.

The final component of the Market Place is the market research module. It is designed to select and retrieve market information from the demand generator according to each team's market research requests. A firm may request an assortment of information, including market demand, competitor advertising decisions, the in-store decisions of distributors or the market's reaction to an ad, a brand or retail prices.

The Market Place fosters a corporate culture where bottom line performance is a prerequisite to success, but where interpersonal skills and business ethics make a difference.

Educational Objectives

The Market Place was designed to achieve five major educational objectives. First, we wanted students to learn to formulate, execute, and control marketing strategies in a real, time-competitive environment. Thus, the emphasis is on strategic marketing, rather than marketing strategy. Whereas both require creativity, qualitative thinking, and an ability to deal with complex tradeoffs, strategic marketing further requries an ability to adapt to a changing environment, a willingness to take risks, and an ability to manage day-to-day issues while trying to position the firm to deal with long-term problems and opportunities. Furthermore, the emphasis in strategic marketing is on action, execution, responsibility, and a manager's role. In contrast, marketing strategy implies a sedentary role of a marketing consultant whose concern is chiefly analysis and planning and who can walk away from the implementation of the plan.

Our second educational objective was to create an environment whereby student teams would have to work with and through other organizations in a channel. In other words, students would have to learn channel management. Distribution channels are not abstract entities, as our textbooks would imply. Channel partners are real people who are every bit as important as the ultimate consumer. It takes more than a financially attractive contract to close a business deal. Interpersonal relationships must be nurtured. Trust, confidence, and integrity must be part of the deal.

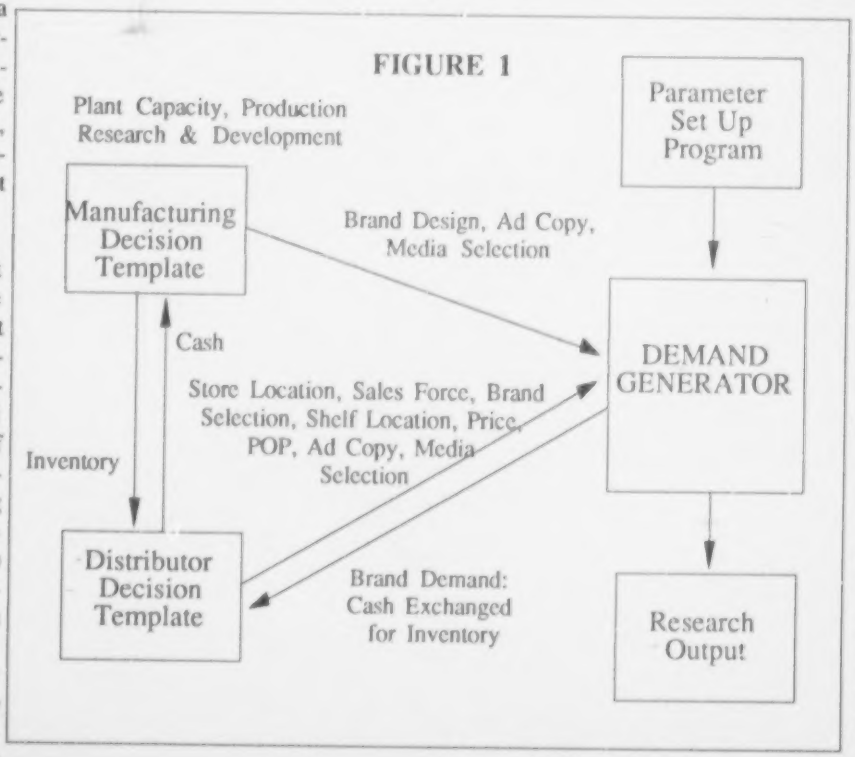
An important feature of the Market Place is that the students' personal ethics are typically challenged during the play of the game. Ethical issues surface during channel negotiations and follow-up decisions. For example, if the team is offered a better deal, should they take it, or do they have some responsibility to current channel partners? If deception will give them a bigger piece of the pie, should they employ it? When does embellishment cross the line into lying? If it was not written into the contract, are they still required to do it? Is winning everything? Business ethics become relevant because the students are faced with some tough choices in their channel relationships.

Our third educational objective was to create an environment whereby students would have to solve business problems by dealing with performance and cost tradeoffs inherent in business decisions. The Market Place was designed so that all decisions were automatically tied into the balance sheet and income statement. To achieve a bottom-line orientation, it was important that students be able quickly and directly to see how every decision affected their cash flow and profitability. In this way, they learn that they cannot solve all of their problems or take advantage of all their opportunities. They are forced to make choices and live with those choices, which, in turn, forces them to think through the pros and cons of each option.

Our fourth objective was to create an environment whereby students would internalize marketing and business concepts and principles through practice in a simulated market. Perhaps the best analogy for comparison would be to learn to speak and think in a foreign language. To develop a conversational familiarity with the language, it is far better to live in the country than to simply study the language in a textbook. By having to deal with the day-to-day problems of bring a product to market, students will more likely develop a conversational familiarity with marketing and business.

Our final objective was to help students develop a working knowledge of microcomputers and business software. In the Market Place, as in busi-

FIGURE 1


Plant Capacity, Production
Research & Development
Parameter Set Up Program
Manufacturing Decision Template
Brand Design, Ad Copy, Media Selection
Cash
DEMAND GENERATOR
Store Location, Sales Force, Brand Selection, Shelf Location, Price, POP, Ad Copy, Media Selection
Inventory
Distributor Decision Template
Brand Demand: Cash Exchanged for Inventory
Research Output

ness, the hardware and software is incidental to the performance of one's responsibilities. Students are not required to study microcomputers, spreadsheets, or word processing, but they are required to use them to be successful in the game. Along the way, they become comfortable with the technology and develop an appreciation for what it can do for them.

Conclusion

No single classroom experience can fulfill the needs of our business school students. Meeting those needs requires a combination of lectures, exams, term papers, case analyses, term projects, simulations, and guidance. As one element in the education mix, the Market Place can make a meaningful contribution to the training and development of our future business leaders. It requires both qualitative and quantitative thinking, theory, and execution, short-term management, and long-term planning. It focuses the students on complex tradeoffs, creative problem solving, risk taking and entrepreneurial decision making, and, importantly, taking responsibility for decisions. Finally, it fosters a corporate culture where bottom line performance is a prerequisite to success, but where interpersonal skills and business ethics make a difference.□

TENNESSEE COMPOSITE ECONOMIC INDICATORS

by Mark L. Burton and David M. Mandy

While the Tennessee economy normally follows national patterns, the timing and magnitude of economic fluctuations in Tennessee often differ from national fluctuations. Thus, a more accurate picture of economic activity in the state can be obtained by examining indicators specific to the Tennessee economy.

One tool available to assess the economic prospects for the national economy is the set of economic indicators reported by the U.S. Bureau of Economic Analysis (BEA). These indicators are compiled into three composite indices designed by the National Bureau of Economic Research (NBER) to lead, coincide with, and lag overall economic activity. Composite indices are more useful than many other measures of economic activity because they become available shortly after the particular activity occurs. Hence, these indices provide a timely view of the national economic environment.

While the Tennessee economy normally follows national patterns, the timing and magnitude of economic fluctuations in Tennessee often differ from national fluctuations. Thus, a more accurate picture of economic activity in Tennessee can be obtained by examining indicators specific to the Tennessee economy.

Beginning this quarter in the *Survey of Business*, leading and coincident composite indices for Tennessee that are analogous to the national composite indices will be reported in each issue. This will be accompanied by an overview of recent economic statistics in Tennessee.

These indices are compiled on a monthly basis by the Center for Business and Economic Research (CBER) at The University of Tennessee, Knoxville and serve as a valuable new resource for evaluating the economic environment of the state. Where possible, we have followed the methodology used by the BEA and the NBER. However, certain aspects of state-level analysis caused us occasionally to depart from the national methodology. These differences are identified below.

Cyclical Turning Points

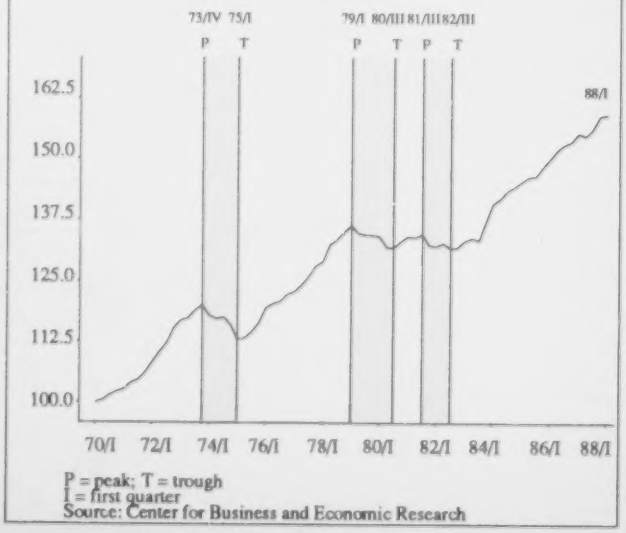
The first step in the construction of composite indices is to identify cyclical peaks and troughs against which economic indicators are then evaluated. There are two basic methods for defining peaks and troughs in an economy. The first involves a comprehensive review of a large number of economic statistics. Turning points in economic activity are then defined at the time when the preponderance of activity changes direction.

The second method involves the use of a **reference series**. A reference series is a broad summary statistic used as a benchmark for economic activity. Under this method, turning points in an economy are defined at the time when the reference series changes direction. The first method is more broadly based than the second, since more data are considered when defining turning points. Thus, the NBER uses the first method to define turning points for the U.S. economy, and these are the turning points used to construct the national economic indices. However, the first method also involves subjective judgement of precisely when the preponderance of activity changes direction. Reference series methods are more objective, since the definition of turning points depends only on the reference series and the methods used to evaluate that series. For this reason, we defined peaks and troughs in the Tennessee economy by the reference series method.

It is important to note that when turning points are defined by a reference series, any composite index based on these definitions is essentially designed to lead, coincide with, or lag the reference series. An index based on a reference series provides summary information about overall economic activity only to the extent that the reference series is an accurate summary of aggregate activity. To minimize any potential error introduced by reference series methodology, a reference series should be the broadest measure of economic activity available. Thus, real gross product for the economy under consideration is often used as a reference series. However, for the Tennessee economy, gross state product is available only on an annual basis, limiting its utility as a reference series. Accordingly, we selected Tennessee real personal income, less transfer payments, as our reference series.

This series was indexed using the techniques described below for candidate economic indicators. Cyclical turns in the reference series index were identified, and the final leading and coincident indices are designed to lead and to coincide with these turns. This is a widely used method of construction, but it dictates that our indices be interpreted as providing information about present and prospective levels of real nontransfer personal income in Tennessee. This interpretation can be generalized to all economic activity only to the degree that real nontransfer personal income is associated with such activity. Figure 1 illustrates the Tennessee reference series index and the corresponding definitions of peaks and troughs in the Tennessee economy. With the exception of the peak in the first quarter of 1979, which preceded the national peak by a year, our definitions of turning points correspond closely with the national definitions.

FIGURE 1
Reference Series Index



P = peak; T = trough
I = first quarter
Source: Center for Business and Economic Research

Evaluation of Economic Indicators

The next step is to define a group of candidate indicators and then evaluate whether the turning points of these indicators mimic the turning points derived above. Six criteria are used by the NBER to evaluate economic variables for the national composite indices. Zarnowitz and Boschan discuss these criteria in "Cyclical Indicators: An Evaluation and New Leading Indexes," *Business Conditions Digest*, May 1975. The criteria are (1) economic significance; (2) statistical adequacy; (3) timing at cyclical turning points; (4) conformity to historical business cycles; (5) smoothness; and (6) timeliness. Table 1 provides a list of the indicators evaluated for inclusion in the Tennessee composite indices. Where applicable, all variables were expressed in real seasonally adjusted terms.

At the national level, there are hundreds of indicators to consider. Hence, a detailed scoring system is used to evaluate each indicator and aggregate these six criteria into a score. Zarnowitz and Boschan describe this scoring system. Currently, the eleven highest scoring leading indicators are used in the national composite leading index, and the four highest scoring coincident indicators are used in the national coincident composite index. Moreover, indicator scores are used to weight each of the components of the national composite indices.

However, at the state level there are relatively few economically significant indicators available in a timely manner on a monthly basis. In addition, most of these variables do not meet Zarnowitz and Boschan's criteria (3), (4), and (5) in a satisfactory manner. Hence, all of the Tennessee candidate indicators that meet these criteria are given equal weight in the Tennessee composite indices. In order to judge the indicators in Table 1 by these criteria, cyclical turning points for each indicator were established by applying to each Tennessee indicator the methodology used by the NBER. Briefly, the NBER method is an

iterative technique in which turning points in twelve-month moving averages are adjusted by comparison with successively less smooth moving averages until the turning points in the indicators are identified. This procedure is described by Ilse Mintz in "Dating United States Growth Cycles," *Explorations in Economic Research*, Occasional papers of NBER, Vol. 1, No. 1, Summer 1974.

Evaluation of the Tennessee candidate indicators required a modification to national techniques. Since our reference series is available only on a quarterly basis, turning points for monthly indicators were defined to be coincident if they occurred during the same quarter as the cyclical turning points derived above. Similarly, turning points for monthly indicators were defined to lead if they occurred during a quarter prior to the cyclical turning points derived above. This evaluation revealed that all the Tennessee candidate indicators display cyclical patterns, with the exception of gasoline gallonage. Total arriving and departing airline passengers was a stable leading indicator before 1978, but airline deregulation, the emergence of Nashville as an American Airlines hub, and the effects of the Republic/Northwest merger on Memphis air traffic combined to render this series too volatile in the 1980's to be of use as an indicator.

Of the other candidate series, some produced superfluous cycles that did not correspond to any reference series cycle, while others were inconsistent, first leading and then lagging the cyclical turns derived above. Several indicators displayed systematic cycles that lagged reference series cycles, making them inappropriate for a coincident or leading index. The indicators that displayed reliable coincident or leading cyclical behavior relative to the reference series are marked in Table 1 with a (c) for coincident and an (l) for leading.

TABLE 1
CANDIDATE TENNESSEE ECONOMIC INDICATORS

Taxable sales(l)
Taxable mortgage lending(l)
Taxable real estate transfers
Taxable gasoline gallonage
Number and value of private construction starts
Number(l) and value of all construction starts
Airline arrivals and departures in Chattanooga, Knoxville, Memphis, and Nashville
Commercial and industrial electricity sales of over 50kwh(c)
Direct electricity sales (direct sales are made to large commercial users)
Help wanted advertising indices for Knoxville, Memphis(c), and Nashville
Initial claims for unemployment insurance benefits(l)
Average duration of unemployment benefits
Continued weeks claimed for unemployment insurance benefits
Insured unemployment rate
Total and durable manufacturing employment
Total and durable manufacturing average weekly hours
Nonagricultural employment
Civilian unemployment rate
U.S. composite index of leading indicators(l)
U.S. composite index of coincident indicators(c)
(c) Denotes a coincident indicator
(l) Denotes a leading indicator

Tennessee Composite Indices

Aggregation of the reliable economic indicators into composite indices followed NBER aggregation procedures except for two alterations in the trending process. First, NBER cycles are defined (for trending purposes) as peak to peak. Data limitations forced us to adopt a trough-to-trough definition. More importantly, because the U.S. composite indices are not tied to a reference series, the trend of the coincident index defines the target trend of the leading index. For our purposes, it seemed more appropriate to trend both the leading and coincident indices to the reference series, using the middle month of the quarter as the definition of monthly turning points. The NBER aggregation procedures are described in the 1984 *Handbook of Cyclical Indicators*, published by the BEA.

The current overview of recent economic statistics begins on the next page. Figures 1 and 2 in the overview illustrate the Tennessee composite indices relative to the cyclical turning points in the reference series. Figure 1 shows that the coincident index usually turns at about the same time as the reference series index. Figure 2 illustrates that the leading index normally turns before the reference series index, with the exception being the 1975 trough.

These graphs also show that the indices fluctuate on a monthly basis, regardless of the direction of the economy. This fluctuation, a result of random variation in economic data, is a property displayed by the U.S. indices as well. Because of this variation, correct interpretation of the indices requires the establishment of a trend before the indices can be regarded as signalling a turning point in the reference series. This point cannot be overemphasized. Single monthly observations of **any** composite index never signal a turn in the economy.

For purposes of evaluating potential turns in Tennessee real nontransfer personal income, we have adopted a "three-month" criterion. During an expansion, three successive months of declines in the leading index can be interpreted as evidence that the reference series will peak within a three-quarter "window" surrounding the declines. Similarly, during a contraction, three successive increases in the leading index can be interpreted as evidence that the reference series will reach a trough during the three-quarter window surrounding the increases. Three-month turns in the coincident index that follow these types of turns in the leading index can be regarded as further evidence that the reference series will turn. Historically, this three-month criterion is fairly reliable, with only one extra cycle indicated by each index.

In addition to the information that will appear in future issues of the *Survey of Business*, each month CBER will issue a monthly press release through The University of Tennessee News Bureau. Each release will be made by the middle of the month and will report the Tennessee composite indices through two months prior. Revisions made after the previous press release will also be included. For example, a mid-November release will contain index values for September, plus revisions for earlier months.□

TENNESSEE ECONOMIC OVERVIEW

The Tennessee composite index of leading indicators increased from 113.7 to 113.8 in September, reversing some of the declines of July and August. At annual rates, the September increase was a meager 0.7 percent, and followed a 1.5 percent decrease in August, when the index fell from 113.9 to 113.7. Following the sluggish behavior in recent months, this modest increase places the September index below the level of September 1987 by 0.1 percent. Some anomalies in September's data pushed the index up, despite slow activity overall. Thus, even though the index increased in September, performance was weak and does not suggest a change from sluggish behavior exhibited in July and August.

Two components of the index showed improvement in September while three components decreased. However, both of the improvements are deceptive so that this month's performance is weaker than a strict interpretation of the data would indicate. First, initial claims for Tennessee unemployment insurance decreased (a positive effect on the index), but the decrease was almost inevitable after the dramatic increase in August. Second, taxable sales exhibited a large increase in September, but this increase must be interpreted with caution because it includes a one-time settlement that is not part of current trend activity.

The other three seasonally adjusted components of the index declined. Construction starts decreased in September following a large increase in August, and a decrease in taxable mortgages confirmed weakness in that sector. The U.S. leading index continued its ambiguity by decreasing a modest 0.6 percent after an increase in August.

The recent sluggishness evident in the leading index also appeared in the Tennessee composite index of coincident indicators in September. This index decreased from 128.6 in August to 127.9 in September, following strong increases in July and August. At annual rates, the September decline was 5.7 percent, while the July and August increases were 8.7 and 10.5 percent, respectively, placing the September index 3.6 percent above September 1987.

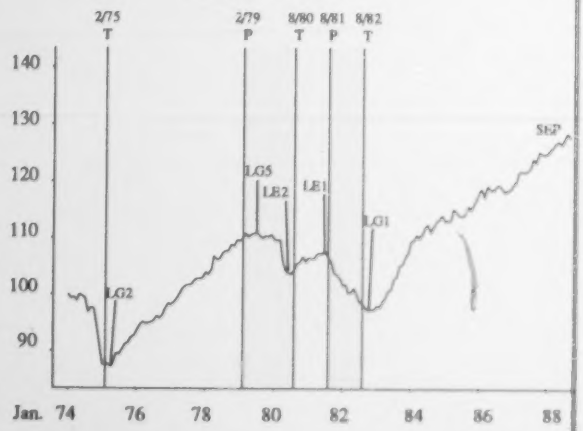
The U.S. coincident index was the only component to increase during September, so Memphis help-wanted advertising and commercial and industrial electricity consumption both decreased. However, preliminary indications are that Memphis help-wanted advertising reversed the September decline in October, so no trend is currently emerging in this statistic.

Other seasonally adjusted indicators have showed weakness in the Tennessee economy. Total nonagricultural employment and manufacturing employment have both declined recently. Manufacturing employment in September was at the same level as September 1987, and total nonagricultural employment increased only 1.4 percent from September 1987 to September 1988. This represents significant slowing, since annual nonagricultural employment growth has exceeded 3 percent every year since 1984. The Tennessee unemployment rate has also increased, from 5.4 percent in April to 6.1 percent in September.

Another disturbing fact is that Tennessee economic growth has slowed relative to U.S. growth. While the U. S. economy has slowed recently, employment and output are both still growing. Real U.S. gross national product growth was 2.2 percent in the third quarter, down from 3.4 and 3.0 percent in the first and second quarters, respectively. U.S. nonagricultural employment in September was 3.7 percent above September 1987. The September U.S. unemployment rate was 5.4 percent, which is as low as any recent month except June, when the unemployment rate was 5.3 percent.

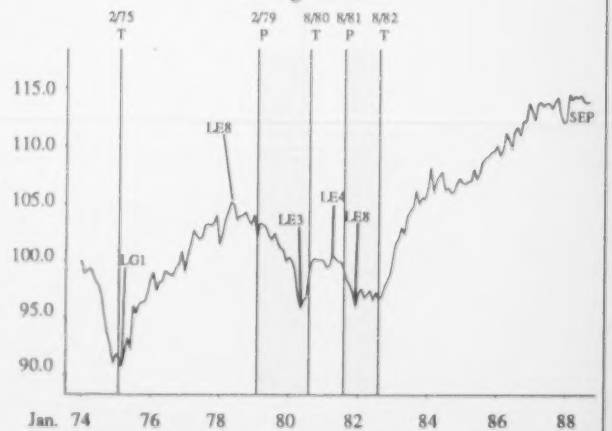
Note: See pages 24-26 for a discussion of the construction of the Tennessee composite economic indicators. For further information, contact CBER.

FIGURE 1
Coincident Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the coincident index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

FIGURE 2
Leading Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the leading index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

TENNESSEE ECONOMIC INDICATORS
SEASONALLY ADJUSTED

	9/87	10/87	11/87	12/87	1/88	2/88	3/88	4/88	5/88	6/88	7/88	8/88	9/88	1985	1986	1987
US Personal Income (BIL 82 $)[1]	3162.9	3212.9	3194.2	3236.6	3214.6	3235.0	3251.1	3242.3	3243.1	3254.1	3262.3	3264.1	3264.4	2978.9	3088.3	3163.5
% Chg Prev Month SAAR	-1.58	20.69	-6.76	17.18	-7.88	7.89	6.15	-3.21	0.28	4.18	3.03	0.68	0.09	3.55	3.67	2.43
% Chg Same Month Last Yr	2.30	3.58	2.79	3.52	3.20	2.93	3.41	3.06	3.20	3.69	3.26	3.06	3.21	3.55	3.67	2.43
US Personal Consumption Deflator (1982=100)	120.8	121.3	121.6	121.7	122.0	122.0	122.6	123.4	124.0	124.3	124.8	125.1	125.7	111.6	114.3	119.5
% Chg Prev Month SAAR	7.22	5.08	3.01	0.99	3.00	0.00	6.06	8.12	5.99	2.94	4.94	2.92	5.91	3.31	2.43	4.50
% Chg Same Month Last Yr	4.86	5.11	5.10	5.00	4.36	4.10	4.07	4.22	4.29	4.10	4.35	4.16	4.06	3.31	2.43	4.50
TN Nonag Employment (THOU)	2021.1	2039.1	2043.5	2042.4	2056.9	2070.4	2060.4	2058.3	2053.3	2054.7	2055.0	2050.9	2049.9	1867.7	1929.6	2008.4
% Chg Prev Month SAAR	5.12	11.23	2.62	-0.64	8.86	8.17	-5.64	-1.22	-2.88	0.82	0.18	-2.37	-0.58	3.08	3.32	4.08
% Chg Same Month Last Yr	4.12	4.60	4.51	4.01	4.22	4.35	3.82	3.50	2.81	2.43	2.33	1.90	1.42	3.08	3.32	4.08
US Nonag Employment (MIL)	102.9	103.4	103.7	104.0	104.3	104.7	105.0	105.3	105.5	106.1	106.3	106.4	106.7	97.5	99.5	102.3
% Chg Prev Month SAAR	2.84	5.50	3.66	3.77	3.04	5.55	3.37	3.01	2.42	6.68	2.40	1.94	2.86	3.20	2.06	2.79
% Chg Same Month Last Yr	2.95	3.25	3.32	3.41	3.44	3.67	3.71	3.61	3.59	3.90	3.75	3.67	3.67	3.20	2.06	2.79
TN Unemployment Rate (%)	6.3	6.3	6.2	6.1	6.2	5.8	5.6	5.4	5.5	5.6	5.8	6.0	6.1	8.0	8.0	6.6
US Unemployment Rate (%)	5.9	6.0	5.9	5.8	5.8	5.7	5.6	5.4	5.6	5.3	5.4	5.6	5.4	7.2	7.0	6.2
Bank Prime Interest Rate (%)	8.7	9.1	8.8	8.8	8.8	8.5	8.5	8.5	8.8	9.0	9.3	9.8	10.0	9.9	8.3	8.2
TN Coincident Composite Index (1/74=100).	123.5	125.3	125.0	124.9	125.1	125.6	126.3	126.8	127.1	126.6	127.5	128.6	127.9	114.6	118.7	122.7
% Chg Prev Month SAAR	-5.57	19.12	-3.34	-0.26	1.57	5.06	6.37	5.51	2.50	-4.28	8.71	10.50	-5.72	2.74	3.52	3.41
% Chg Same Month Last Yr	3.85	6.01	5.40	5.19	4.49	4.71	3.61	3.98	4.37	3.79	4.04	3.61	3.60	2.74	3.52	3.41
TN Leading Composite Index (1/74=100)	113.9	114.2	112.7	112.0	112.2	114.5	114.0	114.4	114.1	114.4	113.9	113.7	113.8	108.0	111.0	113.3
% Chg Prev Month SAAR	6.70	3.81	-15.02	-6.72	1.50	27.86	-5.16	3.92	-2.23	2.94	-5.35	-1.54	0.71	1.16	2.80	2.05
% Chg Same Month Last Yr	2.61	1.53	0.50	-1.49	-0.83	1.99	0.33	0.48	0.58	0.61	0.18	0.43	-0.05	1.16	2.80	2.05
TN Comm & Ind Elect Consump (MIL KWH)[2]	2127	2163	2199	2199	2203	2195	2216	2212	2177	2163	2241	2254	2264	23467	24332	25133
% Chg Prev Month SAAR	19.86	22.32	21.76	-0.11	2.44	-4.28	11.82	-2.10	-17.59	-7.24	52.98	7.49	5.40	2.74	3.69	3.29
% Chg Same Month Last Yr	5.51	0.18	10.08	11.83	10.86	11.77	7.04	8.12	4.83	2.40	7.07	7.59	6.44	2.74	3.69	3.29
Help Wanted Index,Memphis (1967=100)[3]	143	150	143	136	139	140	140	149	156	141	140	150	140	107	125	143
% Chg Prev Month SAAR	-67.40	77.44	-43.64	-45.24	29.93	8.98	0.00	111.20	73.48	-70.27	-8.19	128.85	-56.30	2.14	16.60	13.91
% Chg Same Month Last Yr	15.32	47.06	17.21	12.40	0.00	6.06	-2.10	0.68	9.09	2.17	0.00	-4.46	-2.10	2.14	16.60	13.91
TN Mfg Employment (THOU)	496.4	502.1	502.2	501.7	503.2	503.0	499.6	498.6	497.5	497.9	498.2	498.5	496.4	492.5	490.5	495.4
% Chg Prev Month SAAR	3.90	14.74	0.26	-1.19	3.65	-0.52	-7.82	-2.31	-2.71	0.92	0.82	0.75	-5.05	-0.94	-0.40	1.01
% Chg Same Month Last Yr	1.27	2.43	2.35	1.70	2.28	2.17	1.38	1.39	1.10	0.86	1.01	0.75	0.00	-0.94	-0.40	1.01
US Mfg Employment (MIL)	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.5	19.5	19.5	19.6	19.6	19.6	19.3	19.0	19.1
% Chg Prev Month SAAR	2.86	4.41	4.59	3.22	1.31	1.31	0.93	3.45	1.87	3.38	3.05	-1.16	-1.10	-0.62	-1.53	0.52
% Chg Same Month Last Yr	1.40	1.83	2.21	2.39	2.64	2.58	2.60	2.73	2.74	2.96	2.75	2.42	2.09	-0.62	-1.53	0.52
TN Mfg Avg Weekly Hours	40.8	41.8	42.2	42.1	42.4	41.8	41.9	41.9	41.6	41.7	41.6	41.4	41.5	41.0	41.2	41.6
% Chg Prev Month SAAR	-22.24	35.35	9.82	-0.45	7.08	-14.68	2.20	-0.20	-7.57	2.63	-3.93	-5.90	4.74	0.27	0.66	0.80
% Chg Same Month Last Yr	-1.15	0.23	1.62	2.08	2.50	-1.63	1.19	3.27	0.48	0.64	0.01	-0.70	1.80	0.27	0.66	0.80
TN Taxable Sales (MIL $)	3176	3285	3161	3215	3215	3303	3346	3305	3291	3331	3287	3280	3346	32798	35371	37592
% Chg Prev Month SAAR	-11.06	49.63	-37.01	22.72	-0.09	38.59	16.69	-13.96	-4.92	15.89	-14.94	-2.48	27.00	8.14	7.84	6.28
% Chg Same Month Last Yr	6.64	7.82	5.99	5.64	5.55	11.39	9.20	8.33	6.47	5.94	3.13	2.26	5.34	8.14	7.84	6.28
TN Taxable Sales (MIL 82 $)	2629	2708	2599	2642	2635	2708	2729	2678	2654	2680	2634	2622	2662	29380	30934	31460
% Chg Prev Month SAAR	-17.05	42.40	-38.85	21.51	-3.00	38.59	10.01	-20.42	-10.30	12.57	-18.94	-5.25	19.91	4.69	5.29	1.70
% Chg Same Month Last Yr	1.70	2.58	0.85	0.61	1.14	7.00	4.92	3.94	2.10	1.76	-1.17	-1.83	1.23	4.69	5.29	1.70
Initial Claims For TN UI (THOU)	32.5	28.9	34.7	43.9	38.8	33.0	35.6	30.3	32.7	33.4	29.8	39.1	36.1	537.9	509.4	436.0
% Chg Prev Month SAAR	115.2	-75.5	783.5	1566.7	-76.9	-85.7	148.3	-85.8	154.9	29.6	-74.9	2516.9	-62.2	3.5	-5.3	-14.4
% Chg Same Month Last Yr	-34.12	-25.13	-6.17	5.99	-0.57	-19.31	-9.14	-18.98	-1.06	-7.75	-24.82	28.09	10.81	3.49	-5.31	-14.40
Continued Weeks Claimed For TN UI (THOU).	166.0	151.8	161.1	167.2	170.3	174.3	182.7	153.4	166.5	163.6	148.6	200.2	157.6	2326.9	2230.4	2003.9
% Chg Prev Month SAAR	7.4	-65.8	103.9	55.5	25.0	32.5	75.9	-87.7	166.8	-19.1	-68.4	3455.7	-94.3	14.6	-4.1	-10.2

	85/III	85/IV	86/I	86/II	86/III	86/IV	87/I	87/II	87/III	87/IV	88/I	88/II	88/III	1985	1986	1987
US GNP (BIL 82 $)[1]	3635.8	3662.4	3719.3	3711.6	3721.3	3734.7	3776.7	3823.0	3865.3	3923.0	3956.1	3985.2	4007.3	3618.7	3721.7	3847.0
% Chg Prev Qtr SAAR	4.13	2.96	6.36	-0.83	1.05	1.45	4.57	4.99	4.50	6.11	3.42	2.97	2.24	3.35	2.85	3.37
% Chg Same Qtr Last Yr	3.27	3.60	3.96	3.12	2.35	1.97	1.54	3.00	3.87	5.04	4.75	4.24	3.67	3.35	2.85	3.37
TN Personal Income (MIL $)[1]	54023	55260	56249	57137	58170	58878	60437	61041	62270	64079	64875	NA	NA	53865	57609	61957
% Chg Prev Qtr SAAR	3.78	9.48	7.35	6.47	7.43	4.96	11.02	4.06	8.30	12.14	5.06	NA	NA	6.96	6.95	7.55
% Chg Same Qtr Last Yr	6.23	7.10	6.83	6.75	7.68	6.55	7.45	6.83	7.05	8.83	7.34	NA	NA	6.96	6.95	7.55
TN Personal Income (MIL 82 $)[1]	48235	48859	49602	50297	50715	50889	51523	51338	51805	52740	53089	NA	NA	48251	50376	51852
% Chg Prev Qtr SAAR	0.85	5.28	6.22	5.72	3.37	1.38	5.08	-1.43	3.69	7.41	2.68	NA	NA	3.51	4.40	2.93
% Chg Same Qtr Last Yr	2.91	3.50	3.82	4.49	5.14	4.15	3.87	2.07	2.15	3.64	3.04	NA	NA	3.51	4.40	2.93

1. Annual Rate
2. Source: Tennessee Valley Authority
3. Source: The Conference Board

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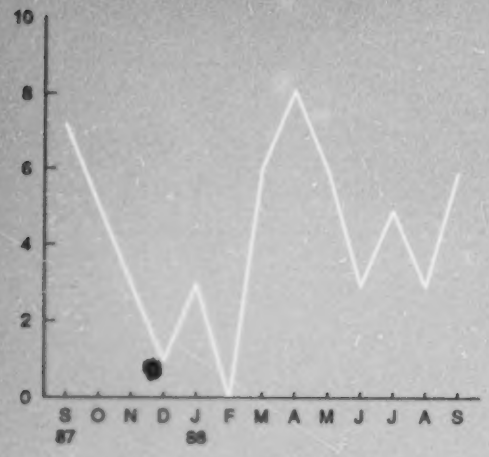
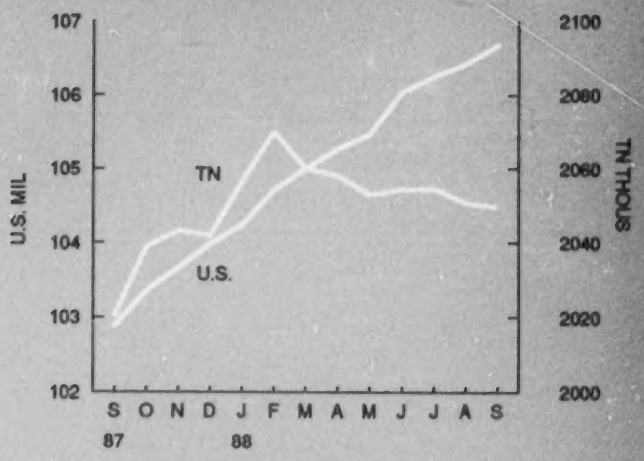
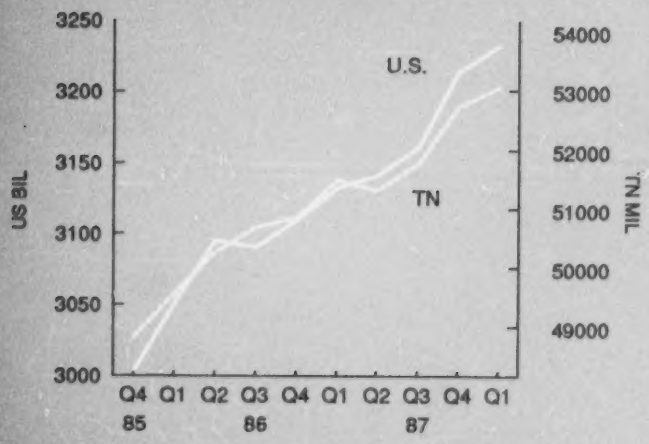
Percent Change in the U.S. Personal Consumption Deflator Seasonally Adjusted



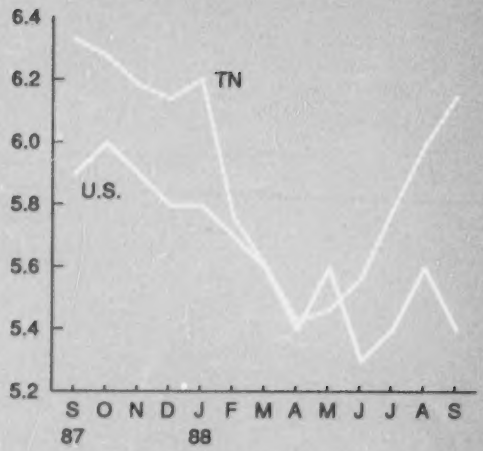
Total Nonagricultural Employment Seasonally Adjusted



Real Personal Income Seasonally Adjusted Annual Rate 1982 Dollars



Civilian Unemployment Rates Seasonally Adjusted



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Survey of Business

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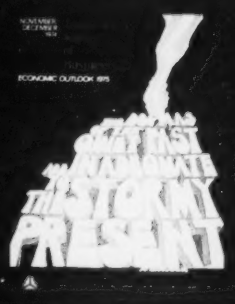
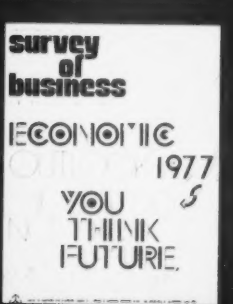
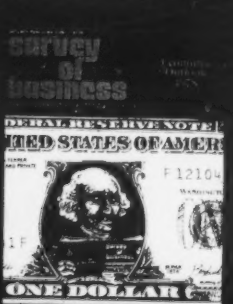
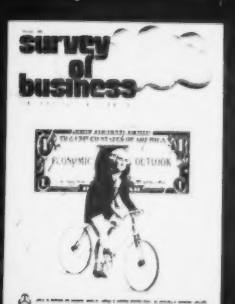
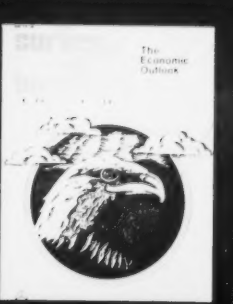
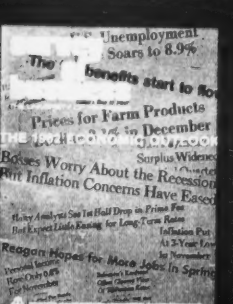


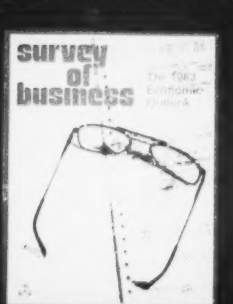


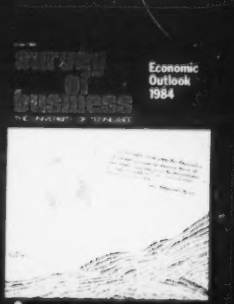


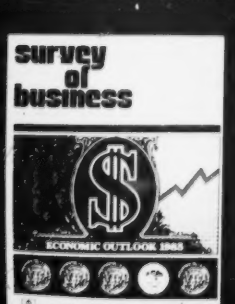


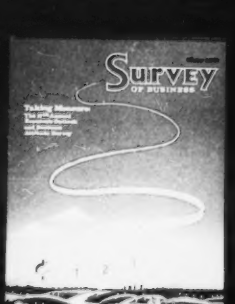


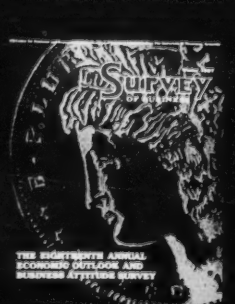

Unemployment Soars to 8.9%
Prices for Farm Products
Bosses Worry About the Recession
But Inflation Concerns Have Eased
Reagan Hopes for More Jobs in Spring

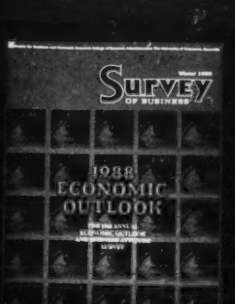












Panelists for the 1989 Survey of Business Attitudes

* **Norbert J. Ackermann, Jr.**, President, CONINCO, Inc., Knoxville
W. G. Adams, Vice President, Tennessee Eastman Company, Kingsport
Herbert G. Adcox, President, Herb Adcox Chevrolet, Chattanooga
★ **James H. Alexander**, Director of Government Affairs, Insurors of Tennessee, Nashville
R. M. Alpert, Jr., President, Lifeguard, Inc., Nashville
* **Charles E. Ashworth**, General Manager, Continental Baking Co., Inc., Memphis
Albert M. Austin, Executive Vice President, Boyle Investment Co., Memphis
* **C. F. Bailey**, Assistant Superintendent of Operations, CSX Transportation, Erwin
† **Alf T. Barnette**, Executive Vice President, West Tennessee Industrial Association, Jackson
Phillip J. Bass, Owner, Bass Manufacturing Company, Camden
▪ **Charles Bell**, Manager, Employee Relations, Allied-Signal, Inc., Knoxville
* **Susan Bies**, Executive Vice President and Chief Financial Officer, First Tennessee National Corporation, Memphis
* **David W. Bird**, Regional Sales Manager, Peterbilt Motors, Madison
Aaron A. Blanton, Plant Manager, General Metal Products Company, Humboldt
▪ **Stephen J. Boyer**, President, Tennessee Retail Federation, Nashville
James A. Breaux, President and General Manager, Bowater Incorporated, Southern Division, Calhoun
J. Don Brock, President, Astec Industries, Inc., Chattanooga
▪ **Berry Brooks**, Senior Vice President, Sovran Bank/Central South, Nashville
Jimmy D. Cagle, Public Relations Manager, Goodyear Tire and Rubber Co., Union City
† **C. Arnold Cameron**, Senior Partner, Cameron and Cameron, Attorneys, Cookeville
◆ **John D. Canale, III**, President, D. Canale Food Services, Inc., Memphis
★ **Richard W. Cardin**, Managing Partner, Arthur Andersen & Company, Nashville
† **William R. Carter**, President, Carter Ltd., Inc., Fayetteville
† **Roger Charest**, Plant Manager, Tupperware Company, Halls
◆ **Edmond D. Cicala**, President, Edmond Enterprises, Inc., Memphis
J. D. Clinton, President, Independent Southern Bancshares, Brownsville
* **David Coffey**, Chairman, Chief Executive Officer, Nucleus, Inc., Oak Ridge
† **Robert B. Colbert, Jr.**, Director, Union Planters Corporation, Memphis, Chattanooga
Harry L. Cole, Plant Manager, Oster, Division of Sunbeam, McMinnville
† **Charles W. Cook, Jr.**, Chairman and Chief Executive Officer, Third National Corporation, Nashville
† **James C. Cotham, III**, Professor of Management, Massey Graduate School of Business at Belmont College, Nashville
Michael Craft, President and Publisher, The Jackson Sun, Inc., Jackson
Robert Neal Culver, Managing Director, Consulting Services Group, Inc., Knoxville
Rick C. Cunningham, Executive Vice President, AFG Industries, Inc., Kingsport
◆ **Roger A. Daley**, Retired Executive, Knoxville News-Sentinel, Knoxville
◆ **Charles H. Dean, Jr.**, Director, Tennessee Valley Authority, Knoxville
* **Sami R. Dietrich**, Executive Director, Dyersburg/Dyer County Area Chamber of Commerce, Dyersburg
Walter L. Dodson, Vice President and General Manager, Custom Urethane Products Company, Parsons
Gerald J. Doyle, Senior Vice President, The MAXIMA Corporation, Oak Ridge
* **Arthur R. Eggert**, Vice President, Manufacturing Operations, Bridgestone (USA), LaVergne
* **Paul M. Engelmann**, Executive Director, United Way of Greater Chattanooga, Chattanooga
† **Joseph R. Exum**, Chairman, Leland Powell Fasteners, Inc., Martin
R. Jack Fishman, Publisher and Editor, Citizen Tribune, Morristown
* **John T. Flaugher**, Executive Vice President, Sovran Bank / Central South, Franklin
* **W. K. Ford**, President, Ford Construction Company, Dyersburg
◆ **William A. Fortune**, Chairman of the Board, FMP Development Corporation, Knoxville
Jerry B. Fussell, President, JBF Associates, Inc., Knoxville
Claude T. Gentry, President, Genco Stamping and Manufacturing Company, Conkeville
† **John F. Germ**, President and Chief Executive Officer, Campbell & Associates, Inc., Chattanooga
Em J. Ghianni, Chairman of the Board, Comforzone Corporation, Nashville
▪ **Buford Goldstein**, President, Hampton Print Works, Inc., Johnson City
Tony Grantham, Controller, Coca-Cola Bottling Works of Tullahoma, Inc., Tullahoma
Alan Gray, Manager, Governmental Affairs, Memphis Area Chamber of Commerce, Memphis
† **Thomas A. Griffin, Jr.**, President, Mid-South Title Insurance Corp., Memphis
† **Joe R. Grooms**, Controller, Martin Marietta Ordnance Systems, Inc., Milan
John D. Haltom, Director, Distribution, United Foods, Inc., Bells
◆ **F. W. Hamilton**, President, Industrial Development and Warehousing, Inc., Jackson
R. Paul Harkins, Sr., Financial Analyst, E. I. Du Pont de Nemours and Co., Memphis
Robert W. Harrison, Chief Executive Officer, The Troxel Co., Moscow
Thomas W. Hart, Chief Executive Officer, Hart's Mfg. Co., Collierville
† **Fred Harvey**, Jr., Retired Executive, Harvey's, Nashville
† **Waymon L. Hickman**, President, First Farmers and Merchants National Bank, Columbia
Ralph E. Hillard, President, Teledyne W-F Industries, Dyer
Terry P. Hoag, Manager, Human Relations, Raytheon Company, Bristol
Stephen B. Holt, Executive Vice President, Kingsport Area Chamber of Commerce, Kingsport
Carter K. Hooks, Executive Director, Obion County Chamber of Commerce, Union City
Edwin C. Hoskins, General Manager, Knoxville Utilities Board, Knoxville
Samuel H. Howard, Chairman, Phoenix Holdings, Nashville
* **Robert L. Huffman**, Industrial Relations Manager, Procter & Gamble Company, Jackson
George Hyfantis, Jr., President, Advanced Waste Management Systems, Inc., Sevierville
Richard W. Ince, President, Elk River Resources, Inc., Knoxville
* **Pat J. Jansen**, Senior Vice President of Finance, Allen & O'Hara Inc., Memphis
* **Glenn W. Jones**, Partner, Research Department, J. C. Bradford Company, Nashville
Dale A. Keasling, President and Chief Executive Officer, Valley Fidelity Bank and Trust Company, Knoxville
Thomas M. Kesterson, President, Kesterson Food Co., Inc., Paris
† **Wendell C. Kirk**, President, Heritage Federal Savings and Loan Association, Kingsport
† **Gene C. Koonce**, President and Chief Executive Officer, United Cities Gas Company, Brentwood
Walter F. Kreuer, Plant Manager, TRW Inc., Ross Gear Division, Lebanon
† **James W. Lail**, President, Raines Brothers, Inc., Chattanooga
Joe E. Lancaster, Chief Executive Officer, Tennessee Farmers Mutual Insurance Company, Columbia
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Gerald F. Lewis, President, United Way of Middle Tennessee, Nashville
◆ **Howard W. Loveless**, President, HAAS INCORPORATED, Memphis
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◆ **John E. McCutchen**, President, E. L. Morgan Company, Jackson
Robert P. McLean, Senior Vice President, AVECOR, Inc., Vonore
John Meahl, Plant Manager, Columbus McKinnon Corporation, Lexington
James Mecredy, President, Market Development Associates, Memphis
Mark A. Medley, President, Control Technology, Inc., Knoxville
William P. Melley, President, France Manufacturing, Fairview
◆ **Merle C. Meyers**, Executive Vice President and Chief Executive Officer, Middle Tennessee Natural Gas Utility, Smithville
Bill Mullican, Jr., Vice President-General Manager, TODCO Wood Products, Alcoa
* **Hugh G. Neil, Jr.**, President, Special Instruments Laboratory Inc., Knoxville
* **Ralph E. Newman, Jr.**, Chairman of the Board, The Bankers Life Insurance Company, Knoxville
Tom Norris, Jr., Vice President and General Manager, Nutronics, Inc., Parsons
Robert E. Oldham, Senior Vice President, Finance and Administration, Red Food Stores, Inc., Chattanooga
▪ **James E. Orgain**, President, Orgain Building Supply Company Inc., Clarksville
† **Joseph Orgill, III**, Chairman of the Board, West Union Corporation, Memphis
* **John L. Parish**, President, Worth, Inc., Tullahoma
Caron Petersen, Assistant Professor, Tennessee State University, Center for Labor Mngmnt. Relations, Nashville
James C. Pickle, President, Erlanger Medical Center, Chattanooga
* **Ivan Pihl**, General Manager, Redfoot Packing Company, Union City
▪ **Richard A. Piske**, Director of Quality Assurance, Allen & Hoshall, Inc., Knoxville
* **Patricia D. Postma**, President, Business Investment Services, Oak Ridge
† **Herman Postma**, Senior Vice President, Martin Marietta Energy Systems, Oak Ridge
* **Harwell W. Proffitt**, Director, Proffitt's, Inc., Alcoa, and Chairman, National Retail Merchants Association
Earl M. Quinley, President, Tri-County Federal Savings & Loan Association, Covington
◆ **James B. Ragland**, Chairman, C. B. Ragland Company, Nashville
† **Richard E. Ray**, Manager, Tennessee Operations, Aluminum Company of America, Alcoa
* **Robert A. Rogers**, Vice President, Administration, Plumley Companies, Paris
Charles R. Ross, Vice President, Finance, Hartmann Luggage Company, Lebanon
John R. Salzer, Plant Controller, Rohm & Haas Tennessee Incorporated, Knoxville
William B. Sansom, Chief Executive Officer, The H. T. Hackney Company, Knoxville
Camden B. Scearce, Vice President Secretary-Controller, The Krystal Company, Chattanooga
Raymond Schultz, President, Hampton Inns, Inc., Memphis
Harold D. Shaw, President, United Way of Greater Memphis, Memphis
★ **James L. Simmons**, Chairman, Tri-City Bank & Trust Company, Blountville
Reese L. Smith, III, President, Haury and Smith Contractors, Nashville
Reuben M. Smith, President, Reuben M. Smith Associates, Inc., Nashville
Ben Smith, Executive Administrative Assistant, Tennessee State Planning Office, Nashville
* **James F. Smith, Jr.**, Chairman and Chief Executive Officer, First American National Bank, Knoxville
* **Gary K. Smith**, President, American Uniform Co., Cleveland
Edward H. Smoot, Senior Consultant, Government Public Affairs, National Bank of Commerce, Memphis
Kenneth V. Spenser, Site Manager, Industrial Systems Division, Texas Instruments MS 3501, Johnson City
* **Andrew J. Spurgeon**, Senior Resident Vice President, Merrill, Lynch, Pierce, Fenner & Smith, Inc., Nashville
† **Carl M. Stanley**, President, Burroughs-Ross-Colville Company, McMinnville
William B. Stokely, III, Chairman and President, The Stokely Company, Knoxville
Lonnie J. Stout, President and Chief Executive Officer, Winners Corporation, Brentwood
Herbert St. Goar, President and Chief Executive Officer, Dixie Saving Stores, Inc., Chattanooga
* **Thomas E. Sudman**, President, Digital A. V., Knoxville
† **William H. Swain**, Chairman of the Board and Chief Executive Officer, First National Bank of Oneida, Oneida
▪ **James W. Terry**, Executive Vice President, Union Planters National Bank, Jackson
Ray Thomas, Executive Vice President and Treasurer, Home Federal Savings Bank of Tennessee, Knoxville
◆ **W. Neil Thomas, Jr.**, Partner, Shumacker and Thompson, Chattanooga
† **J. R. Thompson**, Vice President, Finance, TPI Corporation, Johnson City
Rayburn Traughber, Commissioner, Tennessee Department of Employment Security, Nashville
W. S. Travis, President, Travis Meats, Inc., Powell
* **Earl H. Triplett**, Consultant, Clark Tower, Memphis
Thomas M. Tucker, Secretary, Power Equipment Company, Knoxville
* **Richard E. Tumblin**, CLU, Chartered Financial Consultant, Equitable Financial Companies, Knoxville
† **John M. Upchurch**, Appraiser and Land Surveyor, Buchanan
* **Jack D. Whitfield**, President, Sverdrup Technology, Inc., Tullahoma
Kenneth G. Williams, Director, Commercial Unitary Mfg., Carrier Corporation, McMinnville
James E. Willis, Plant Manager, Central Soya Company, Inc., Chattanooga
Charles M. Wilson, President, CMW, Inc., Memphis
Carter H. Witt, President, Tennessee Association of Business, Nashville
Albert Wofford, Tennessee Group Controller, Seigel Robert, Inc., Ripley
Charles E. Wolfenbarger, President, International Union of Electricians, Local 748, Jefferson City
▪ **W. Lewis Wood, Jr.**, Senior Vice President, Allen & Hoshall, Inc., Memphis
Frank Wylie, President, Grace and Wylie Fabricators, Inc., Brentwood
* **Thomas L. Yount**, Investor and Consultant, Nashville
† **Allen Zang**, President, Nashville Bridge Company, Nashville
Alexander Zucker, Acting Director, Oak Ridge National Laboratory, Oak Ridge

★ These panelists have served 20 years.
◆ These panelists have served 15 or more years.
† These panelists have served 10 or more years.
* These panelists have served 5 or more years.

C O N T E N T S

Comments *by David A. Hake*	**2**	*David A. Hake is Director, Center for Business and Economic Research, and Editor, Survey of Business*
Five Panelists Reflect on the Last 20 Years	**3**	*James H. Alexander, Richard W. Cardin, James C. Cotham, III, James L. Simmons, and W. Lewis Wood*
Demographic Profile of the 1989 Economic Outlook Panel	**7**	*An analysis of the geographic distribution of this year's economic outlook panel.*
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Survey
OF BUSINESS

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Comment

This is the twentieth annual Outlook issue of the *Survey*. It is hard for me to realize that we have been involved with each one of these special editions that focus on expectations for the year ahead. Twenty years is a long time to do anything. But such an involvement does give one perspective, or at least the illusion of perspective, even though there is a temptation to overvalue the mere passage of time. The "illusion" of perspective, I begin to realize, is about all I have of those 20 years. Many things I thought were impossible have eventually yielded to persistence.

Some wise person said, "The only constant is change." As our social, economic, and political environment changes around us, so must our knowledge or understanding of it. However, our market economic system is rich in data to the point of perceptual overload. As we each form our own unique perceptions of the changed environment as a background to action, it often helps to ask the opinions of others. Since 1970, executives from business, industry, education, and government across Tennessee have been willing to participate in this sharing exercise.

This year, 154 executives comprise the 1989 Outlook Panel. Their opinions about the national and state economic environment are included in the article beginning on page 4. And this year, to mark our 20th year, the founder of the Outlook Questionnaire and four long-term panelists were asked to write comments on their extended affiliation with this annual process.

Summary comments from the 1989 Outlook Panel on the economic "State of the State" are contained on pages 22 and 23, and in a special section this year, Paula Kaufman and Angie LeClercq report on the 1989 Outlook Panel views of the value of external information.

The cover of this issue depicts the covers of each of the preceding 19 years of Outlook issues. To counterbalance the tug toward nostalgic reflection, contemplate the 20th Outlook cover panel, which itself contains the 20th Outlook cover panel, which itself again contains the 20th Outlook cover panel. Our goal for the present and the future remains as it has been in the past--to help decisionmakers in Tennessee sharpen their understanding of the past and the present environment with a face toward the Outlook for the future.

David A. Hake
Director, CBER

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FIVE PANELISTS REFLECT ON THE LAST 20 YEARS

Twenty years ago -- in 1969 -- economic conditions in the state and the country reflected the ravages of the Vietnam war abroad and the GM auto strike at home -- inflation, unemployment, and falling corporate profits and worker productivity.

That year Jim Cotham, then director of the Center for Business and Economic Research, and his staff decided to find out what business, education and government leaders across Tennessee thought were the greatest strengths and weaknesses of the state and what economic effects they predicted for the coming year.

From the opinions and personal forecasts of 60 individuals, a tradition was born. For the last 20 years, leaders throughout the state have continued to respond enthusiastically to questions about changing trends and economic cycles and have fearlessly projected their judgments about numerous aspects of the state and national economy.

This year, the opinions of 154 panelists are included in our projections. On this page, five long-term panelists reflect on their participation on the panel.

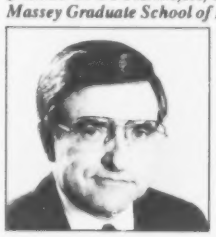
JAMES H. ALEXANDER, *Executive Director, Insurors of Tennessee, Nashville*

I have considered it a distinct honor to serve as a panelist on the Outlook issue of the Survey for the past 20 years. I appreciate being selected to serve with such a distinguished group of Tennessee citizens in presenting our views and predictions for the economy of the U.S. and Tennessee. I have attempted to present my views, based on both my background as a small businessman in a small town, plus eight years in state (Continued on page 4)

RICHARD W. CARDIN, *Managing Partner, Arthur Andersen and Co., Nashville*

During the last 20 years, I have had the opportunity to see tremendous changes in Tennessee. We have experienced inflation, high interest rates, perceived or actual shortages of energy, increased cost of energy, shortages of capital, high levels of construction activities, deflation, lower interest rates, recessions, high unemployment, and low levels of construction activity. However, over this period Tennessee has also experienced sustained (Continued on page 4)

JAMES C. COTHAM,III, *Graduate Professor, Management Strategy and Policy, The Jack C. Massey Graduate School of Business, Belmont College, Nashville*

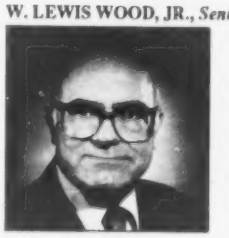


It is with a great sense of pride that I look back 20 years and reflect on two decades of business forecasting by panels of service-minded executives from business, labor, government, industry and education across Tennessee. The Outlook Editions of the Survey of Business were designed to provide a forum for knowledgeable people from every geographical region of the state and every sector of the economy to share their views (Continued on page 4)

JAMES L. SIMMONS, *Consultant and Member, Board of Directors, Tri-City Bank and Trust Co., Blountville*

Twenty years ago, when I was first asked to serve on this panel for a survey of business attitudes and developing economic trends in Tennessee, I was both honored and pleased to accept. Fifteen years earlier I had moved from the mountains of Middle Tennessee to the more industrialized East Tennessee area; therefore, I knew firsthand how economic attitudes and trends can differ throughout our state. (Continued on page 5)

W. LEWIS WOOD, JR., *Senior Vice President, Allen and Hoshall, Inc.*



In 1971, when you first requested my participation in your survey I was pleased to have been asked to be a part of such an outstanding panel of Tennessee business and professional executives. The broad cross-section of outside sources of information and your continuing to update and expand the panel have contributed to the quality of publication which has not only impressed me, but has served as an important tool in the conduct of my (Continued on page 5)

(Articles continued from p. 3)

JAMES H. ALEXANDER

(continued) government at the cabinet level, along with 17 years as Executive Director of a large trade association in Tennessee.

I feel this service has been most helpful to me by demanding that I take an "annual examination" of the various issues and economic factors affecting our country and our state. It has caused me to give more serious and detailed thought to various issues that I might have otherwise given only passing thought. Participation in the program each year has re-enforced my strong belief in Tennessee and Tennesseans - that we do have an outstanding state comprised of fine citizens who believe in good government at the local and state level and a state which is taking full advantage of its very strategic location in the area of economic growth and development.

I do hope I have been able to make a contribution by this participation in a business publication that is valuable to all Tennesseans. It has been an honor and a pleasure and I wish the Center for Business and Economic Research continued success in their efforts.

Participation in the program each year has re-enforced my strong belief in Tennessee and Tennesseans - that we do have an outstanding state comprised of fine citizens who believe in good government at the local and state level and a state which is taking full advantage of its very strategic location in the area of economic growth and development.

RICHARD W. CARDIN

(continued) growth in the creation of new jobs and income for its citizens. Overall, we have met these challenges and our state has made substantial progress.

In spite of many changes, as I reflect on the top five key economic issues identified by the panelists over the last 20 years, I find three of the issues appearing in the top five almost every year: 1) scarcity of skilled workers, 2) level of unemployment, and 3) total business costs increasing faster than revenues. I would certainly not minimize the issue of total business costs increasing faster than revenues because this issue has usually been one of my top five each year. However, I am encouraged that somehow during the last 20 years, we have found ways to meet the challenge of this issue through increased productivity and effectiveness because I believe Tennessee's businesses and overall economy are stronger today than 10 or 20 years ago.

The other two issues, level of unemployment and scarcity of skilled workers, present continual challenges in a world of change. I certainly do not have the answers to resolving these issues, but I do believe education is important in the long-term solutions in Tennessee. While improved education at all levels is a high priority, a continued strong commitment to higher education is needed for continued economic development for our state. This is one of the reasons I have personally supported not only the economic outlook *Survey*, but various other activities of The University of Tennessee for over 20 years.

I believe the survey represents an excellent "consensus poll" of those issues which a cross section of outstanding Tennessee business leaders believe will effect our business affairs and our state. I would encourage panelists to continue to participate and support the survey each year. We can all benefit from this consensus of attitudes illustrating what is important to our business leaders.

I challenge the editors of the survey to be creative in structuring the questionnaire in future years to challenge the panelists about current and future issues facing business in our state. Issues such as the changes in the work force (male/female, one-parent households, day care, demographics of work force, etc.), effects of technology in businesses, the impact of a global economy, environmental issues, quality of life, etc., may be more important than issues such as availability of energy, transportation, etc., that have been included in recent questionnaires.

What will the next 20 years bring to our state? I expect it will be more change, challenges and opportunities for all of us. I believe that U.T. can play an important role in helping business, government and our citizens meet these challenges and continue the improvement in Tennessee's economic development.

What will the next 20 years bring to our state? I expect it will be more change, challenges and opportunities for all of us.

JAMES C. COTHAM

(continued) on an variety of economic trends and to speak out on social issues important to the well-being of Tennesseans and the nation.

That era was a period of transition for The University of Tennessee. Dr. Andrew Holt was preparing to pass the reins of leadership to Dr. Edward Boling. Dr. Charles Weaver was Chancellor of the Knoxville campus as part of a comprehensive reorganization of the university system. Dr. Arthur Warner was Dean of the College of Business Administration.

On the national level, key economic indicators in 1970 reflected "excess inflation and unemployment resulting from the Vietnam war" as described by the first Outlook issue. These numbers, a 4 percent increase in the Consumer Price Index and a 5 percent joblessness rate, were also influenced by a protracted General Motors auto strike. Corporate profits were down 10 percent, attributed largely to a loss in worker productivity and higher wages. Tight money prevailed throughout the country. Growth in GNP was slow due to the auto strike, which lasted longer than anticipated.

Tennessee's economy generally mirrored the nation's at the time, with the exception of unemployment, which remained below the national level due to a slow rise in the labor force.

It was with this background of economic uncertainty that 60 brave souls agreed to participate in the first Annual Business Attitudes Survey of economic prospects for the year 1970. They were also asked to stick their necks out and identify the major social issues potentially facing the state in the decade of the 1970s.

What was on the front burner as key issues for Tennessee in 1970? On the economic side, the consensus was for a slight upturn for business activity. An inadequate supply of investment capital was ranked as the most critical problem facing Tennessee businesses at the time. This was closely followed by demands for wage-rate increases, higher interest rates, higher operating costs and a slowdown in residential costs as priority concerns. But overall, "cautious optimism" was the overall tone of the panel.

Key social and public policy issues confronting Tennesseans for the decade ahead, listed in order of priority, were the need for urban planning, minority-group unrest, low spending for public education, inadequate tax revenues to support government services, and an increased crime rate.

Interestingly, many priority issues of 20 years ago, as expressed by panelists, are still hot topics for debate today. As a matter of information, other critical problem areas mentioned were a lack of high-quality streets and highways, inadequate supply of housing and high levels of air and water pollutions. It would not be until 1971 that the illegal use of drugs would emerge as a priority concern.

Back in 1969, when the Center for Business and Economic Research staff discussed the pros and cons of creating the Outlook Panel concept, an argument in favor of the project was the lack of opportunity for citizens to be heard on issues important to them. On the other side was the fear that the panel could not be sustained year after year.

Reviewing the composition of the panel for 1989 indicates a well-established group with three colleagues (who are heard from in this article) having stayed the course for the entire 20 years. It is also gratifying to note that 19 panelists have participated for 15 years or more and 24 have been involved for 10-15 years.

Equally as impressive is the expansion of the membership from 60 panelists the first year to 154 for 1989. This speaks well of the credibility of the Center for Business and Economic Research staff.

For the past two decades, The University of Tennessee has provided an important service by sharing the views of distinguished leaders from every economic sector and geographical regions throughout the state. The Outlook Edition, with its forum of panelists, has played an increasing role in focusing public opinion on matters of concern to Tennesseans and the country. I'm proud to have been a part of the team that made it happen 20 years ago.

Many priority issues of 20 years ago, as expressed by panelists, are still hot topics for debate today.

JAMES C. SIMMONS

(continued) I was excited about the concept of the Tennessee Econometric Model and how the input of these panelists could furnish a grassroots opinion from every segment of our varied state economies. I looked forward with great interest to the first issue to see how my own assumptions (which still were being influenced by my Middle Tennessee roots), would fare with the majority opinion of the panelists. I have continued to look forward each year to this participation and the winter issue of the *Survey of Business* as an important annual review of the state as a whole and the economic outlook for the year to come. Each area of the state has seen many changes in their economic base in the past 20 years, and I believe the Econometric Model has helped businessmen keep the right perspective.

In the beginning I knew a large percentage of the panelists personally, but through the years, as names have changed for various reasons, I am pleased to be among the survivors along with Dick Cardin, Jim Alexander, and Jim Cotham.

I look forward each year to this participation and the winter issue of the ***Survey of Business*** *as an important annual review of the state as a whole and the economic outlook for the year to come.*

W. LEWIS WOOD

(continued) business as Senior Vice President and Director of Business Development for Allen & Hoshall, Inc.

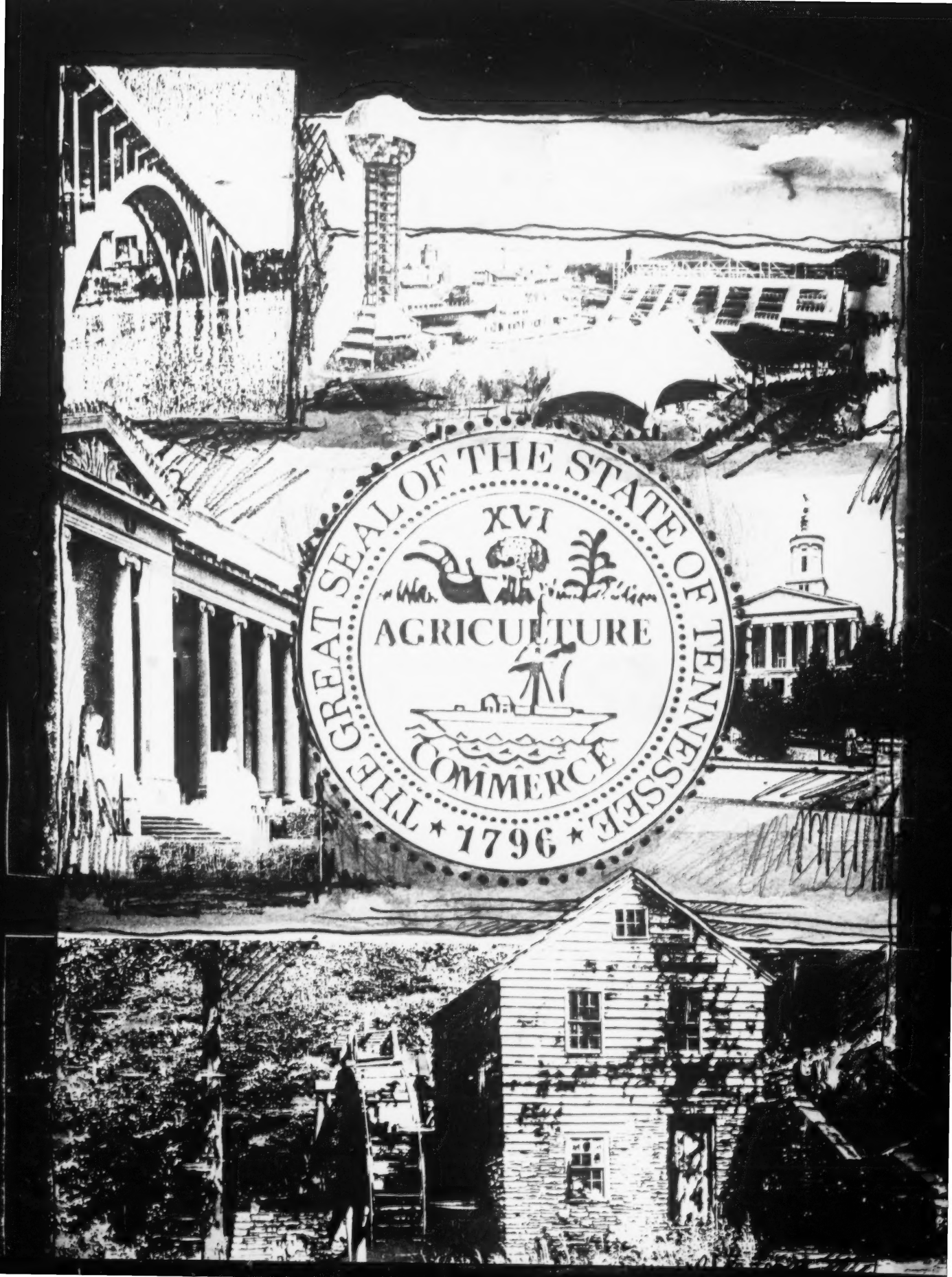
Our firm is a large architectural-engineering firm, headquartered in Memphis with branch operations in Nashville, Knoxville, and Chattanooga. We have been in continuous operation since 1915, designing important industrial, utility and public works projects throughout the State of Tennessee.

This statewide operation not only gives me a knowledge of the heavy construction market throughout the state, but the success of our firm in landing new design contracts is a definite leading indicator, since design must proceed building permits or award of construction contracts.

An explicit indication of this is the fact that our new business has increased each of the last six years since 1982 at a rate in excess of 15 percent per year, and in the past two years our backlog of work has built to the highest level in history. This in our opinion, coupled with similar work loads of other design firms, indicates the high level of construction activity which will continue to take place in the next several years.

The Survey of business attitudes conducted by you has provided me with a good opportunity to stay abreast of the economy by researching my sources and in analyzing the data.

My background includes a degree in electrical engineering from The University of Tennessee, coupled with a later degree in law from Memphis State University--hardly the background in economics which is so vital to planning and implementing the development of business. Consequently, the Survey of Business attitudes conducted by you has provided me with a good opportunity to stay abreast of the economy by researching my sources and in analyzing the data. Likewise, this has created a greater interest on my part in the survey results and in the practical application of these results in my company as Director of Business Development. ■


THE GREAT SEAL OF THE STATE OF TENNESSEE
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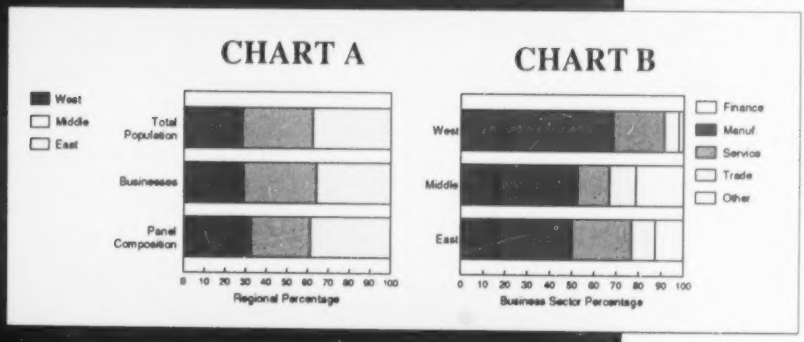
COMMERCE
1796

DEMOGRAPHIC PROFILE OF THE 1989 ECONOMIC OUTLOOK PANEL

The 1989 Economic Outlook Panel is made up of 154 business leaders from ali major sectors of the Tennessee economy. In the following article, these members of the twentieth anniversary panel share their expectations for the U.S. and Tennessee economies from their business perspectives as well as their regional perspectives. Of the total of 145 responses included in the data tabulation and analysis, most of these, 126 responses, were received prior to the November 1988 elections. Another 19 were received election week, and 9 responses were received after tabulations were complete. However, comments from all respondents provided valuable direction for this article.



The tabulation of data by geographic location includes 47 responses from West Tennessee, 42 from Middle Tennessee, and 56 from East Tennessee. Chart A describes the geographic distribution of the Outlook Panel as well as the geographic distribution of the population and business sector employment in Tennessee. The data sources for the latter are *Current Population Reports* and *County Business Patterns*, both published by the U.S. Department of Commerce, Bureau of the Census.

Data are also tabulated according to five industry group designations. Responses to the Outlook '89 survey include 57 manufacturers, 32 service sector panelists (including chambers of commerce, United Way agencies, consulting firms, accountants, architects, and attorneys), 25 finance panelists (including banks, savings and loan associations, and insurance companies), 14 trade sector panelists (including wholesale and retail), and a fifth category designated "other," which includes 17 business leaders from construction, labor, education and government.

Chart B depicts the industry group composition of each geographic sector.

THE 20th ANNUAL BUSINESS ATTITUDES SURVEY

by David A. Hake, Kenneth E. Quindry and Betty B. Vickers

PART I: NATIONAL ISSUES
A. International Trade and Investment
B. Federal Fiscal and Monetary Policy

PART II: TENNESSEE CONCERNS
A. Economic Environment
B. Education: Equality and Quality

PART III: ECONOMIC OUTLOOK SUMMARY FOR 1989

PART IV: KEY ECONOMIC ISSUES FOR 1989

PART V: INFORMATION USE IN TENNESSEE

In this 20th Annual Business Attitude Survey, 154 Tennessee business leaders were given the opportunity to express their views on the state and national economy. The consensus about economic performance in 1989 is generally optimistic; however, panelists view with concern some public sector developments that influence economic performance. Of particular concern is the continuing federal budget deficits and negative trade balances. At the state level, the panelists favor improvements in education and the public sector infrastructure as means of attracting business and industrial investment to the state.

The 1989 survey questionnaire is divided into five parts. Parts I and II deal with the public sector's performance and its influence on economic growth and prosperity. Parts III and IV explore the panelists' opinions concerning Tennessee's economic outlook. Part V deals with issues relating to the availability of externally generated information critical to effective business performance.

PART I
NATIONAL ISSUES
Summary

Part I of the 1989 Economic Outlook Survey deals with national issues. The current economic expansion which began six years ago is expected to continue well into 1989. A growing sense of optimism continues, but if we go into a new administration with no real plan to deal with economic issues, a financial crisis may become a real threat--this despite recent lower unemployment rates, improvements in manufacturing output, and a reduction in the negative trade balance. Among the issues

other than maintaining vital services and benefits are the necessity to further reduce budget and trade deficits, maintain the value of the dollar, keep interest rates and inflation in check, maintain a strong defense, and avoid a tax increase, if possible. All these factors are considered critical to continued economic growth and prosperity.

The U.S. economy now appears healthy, but serious underlying problems exist. They must be faced early in the new Administration. The first series of questions deals with the foreign trade balance and foreign investment in the U.S. Bulging trade deficits and foreign investment in the U.S. (in excess of U.S. investments abroad) changed the U.S. from a creditor nation to a debtor nation in the 1980s. The U.S. now owes the world about $500 billion more than the world owes the U.S. The negative foreign trade balance reached $160 billion in 1987. Of that amount, over $137 billion was in manufactured goods alone, somewhat lower in 1988. By a wide majority, the panelists believe that the negative trade balance and creditor nation status inhibit economic growth and prosperity despite the continued economic expansion of the 1980s. They believe that fiscal and monetary policy can contribute to economic improvement, especially as they control the value of the dollar, balance the federal budget, and keep interest rates and inflation low.

FIGURE 1 A
U.S. Current Account Balances 1979-1988.3
(Billions of Current $)

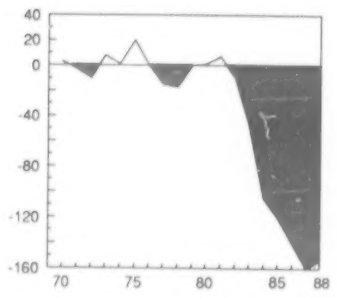
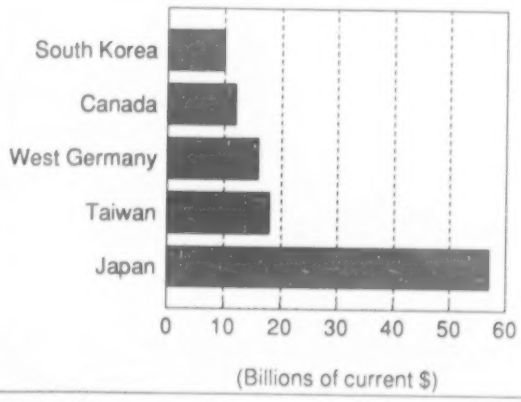


FIGURE 1 B
U.S. Trade Deficits by Country, 1987

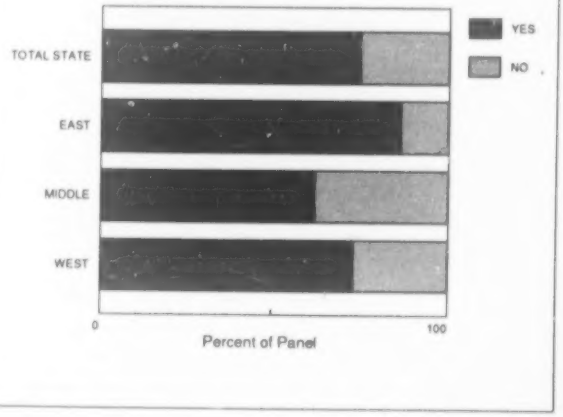


The U.S. has become a creditor nation, and this status inhibits loan growth and prosperity. Reducing the budget deficit was given high priority by the panelists. A prime cause of the deficits is expenditure growth. Federal revenues grew significantly faster than inflation from 1980 to 1988, but expenditures grew even faster. Graham-Rudman has cut the growth in expenditures greatly in the last two years and the annual deficit has shrunk by one-third. If spending discipline can be maintained, modest economic growth will gradually reduce the deficit. But a reversal can quickly develop if economic growth falters. There is only a narrow margin of safety, and after two years of restraint, pressures are growing for new expenditures. About two-thirds of the panelists, however, believe that expenditure restraint and growth will be sufficient to reduce the deficits.

Monetary policy can be used to supplement fiscal policy in regulating the economy. A majority of the panelists do not believe that the economy is faced with excessive interest rate increases and inflation. However, if these were a threat, an effective way of cooling the economy would be through higher discount rates and interest rates.

Finally, the panelists do not believe that either Congress or the Administration now has a real policy to curb excessive expenditures. While Congress and the Administration are given the primary responsibility for the bulging federal deficits, panelists are quick to recognize the influence of powerful special interest groups. Though ultimately responsible for expenditure excesses, Congress and the Administration are reluctant to turn aside any requests for funds that translate into votes.

FIGURE 2
Does the Trade Deficit Inhibit
U.S. Economic Growth and Prosperity?



International Trade and Foreign Investment

Figure 1A shows the U.S. current account balance, and Figure 1B shows 1987 U.S. trade deficits for the five leading U.S. trading partners. Because of the large negative current account balance and heavy foreign investment in the U.S., the U.S. has become a creditor nation. Following recent declines in interest rates, the budget deficits and the declining value of the dollar, the negative trade balances are being modestly reduced in 1988. The negative balances imply that the U.S. is living beyond its means. Can it continue to maintain economic vitality while borrowing and consuming more than is saved and produced? The majority of the panelists believe not (Figure 2). The panelists responding believe there is a direct link--that trade deficits inhibit economic growth and propensity. The belief that trade deficits were an economic restraint were fairly equally distributed geographically and by industry (Figures 2 and 3). Following is a quote from a manufacturing panelist from East Tennessee.

International investment is a very real part of participating in world trade. We should not fear it. International trade is affected most by manufacturing cost. To this end we have a critical need for investment to upgrade our factories and workers. Investment tax credit should be a key part of public policy. It should apply to engineering, machines and skills. **Manufacturer, East Tennessee.**

The panelists were next asked to rate several alternatives as to the effect they might have on reducing the trade deficit. The results are presented in Figure 4. Almost two-thirds of the panelists believed further devaluation of the dollar would aid in reducing the negative trade balance, while only one-fourth believed it would worsen the situation.

The cheaper dollar has brought back a great many products manufactured in foreign countries. The foreign investors coming into this country using U.S. labor and operating under basically U.S. conditions have shown us that we can compete in the world market, if we have the proper attitude towards competition and just get the ball rolling to improve productivity and quality. **Manufacturer, West Tennessee.**

The panelists were almost unanimous in the belief that worker productivity would improve the nation's competitive position in foreign trade. Fiscal and monetary controls (e, f, g) could be used effectively in some areas, but trade protectionism was highly disfavored (b, d). Finally, panelists said that an increase in research would be highly beneficial.

Responses by geographic regions compare favorably with statewide responses. Support or lack thereof for each alternative by industry is generally constrained. Minor variations in industry support are generally attributed to an industry point of view as to how an alternative will affect the particular industry. The most prominent variation from statewide opinions is in the trade industry. Panelists engaged in trade were less heavily in favor of import controls and more heavily in favor of export controls than the state panelists in general.

Over half of the panel believed the nation should seek to return to a creditor nation status in order to improve economic perfor-

FIGURE 3
Do Deficits Inhibit State and Regional Economic Growth?

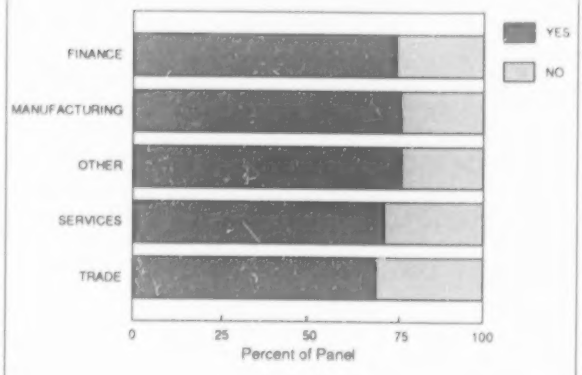


FIGURE 4
Ratings of Alternatives to Reduce the Deficit

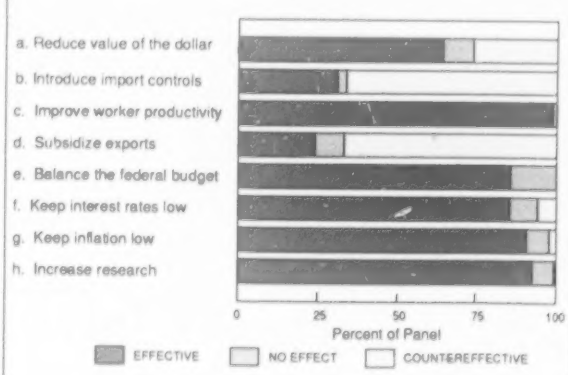
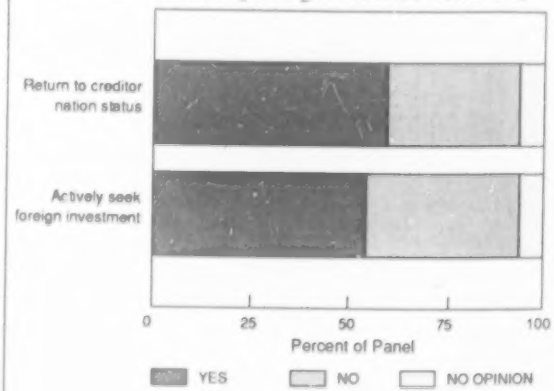


FIGURE 5
Alternatives For Improving Economic Performance



mance (Figure 5). By the same token, over half believed government should actively seek foreign investment.

Fiscal and Monetary Policy

As noted above, the panelists expressed considerable confidence that the nation's economy can be influenced (if not controlled) by fiscal and monetary policy. Fiscal policy is affected through taxing and spending policies. Monetary policy deals with the control of the money supply, through interest rate controls (discount rate) and lending regulations by the Federal Reserve System.

Fiscal Policy. Over four-fifths of the panel believe that the federal budget deficits inhibit economic growth and prosperity. Sixteen percent do not believe so, while 2.8 percent expressed no opinion. By a large majority (85.4 percent), the panelists believe a balanced budget would serve to reduce the negative trade balance. But there was less agreement when alternatives to balancing the budget were examined.

One tool for deficit reduction is expenditure controls. Table 1 lists three broad categories of federal expenditures. The panel was asked to express an opinion on cuts for each, assuming no tax increase. Of the respondents, 62.1 percent registered a desire to reduce defense spending, 77.9 percent to reduce entitlements, and 86.2 percent to reduce general government. Some panelists favored decreases in two or three categories, and a few expressed a desire to increase one category at the expense of broad decreases in others. A significantly high percentage do not favor a reduction in defense expenditures.

The responsibility for fiscal and monetary policy may be shared by Congress and the Administration, but as a practical matter it should be blamed entirely on Congress, which always declares the Administration's proposed budget dead on arrival and then proceeds to ignore proper budget procedures and present a continuing resolution which has to be accepted or government closes down. To be sure, a semi-balance of a budget was presented this year, but again at the last moment, with no feasible alternative and no line item veto. **Service Sector Executive, East Tennessee.**

In its effort to stay in office, Congress is reluctant to turn aside any request for funds. It has shown little responsibility concerning budget balancing. It will fritter away any increase in taxes. **Manufacturer, West Tennessee.**

A second alternative for reducing the deficits is to increase taxes. Almost two-thirds of 143 panelists think that a tax increase is not needed, believing that the budget deficit is not a problem, or they would rely on expenditures, restraints, or economic growth to reduce the deficit.

If taxes are to be increased, the panel favors higher consumption taxes. However, only one-third believe a tax increase is desirable or necessary. Just over one-third of the respondents favor a tax increase. But if a tax increase were to be used as a tool, they favored increased taxes on consumers (on tobacco products, liquor, etc.) (Table 2). Corporation tax increases ranked second, and personal income taxes third in the survey responses. Panelists favor expenditure restraints and economic growth for a gradual reduction in the budget deficits.

Table 1
Panelist's Opinions on Federal Expenditure Reductions
(By Percent)

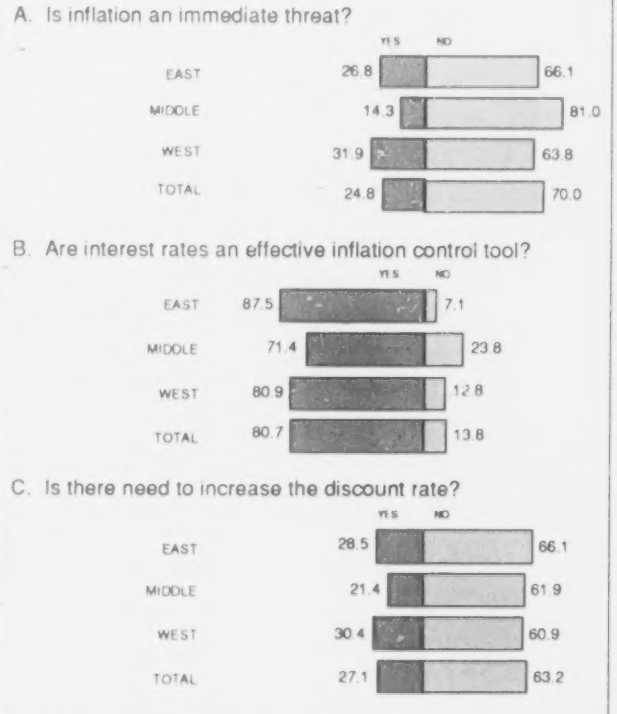
	Increase	Decrease	No Change	No Response
Defense	2.1%	62.1%	35.2%	0.7%
Entitlements	2.8	77.9	18.6	0.7
General Govt.	1.4	86.2	11.7	0.7

Table 2
Panel Preferences for Potential Tax Increases
(By Percent)

	First	Second	Third
Personal Income Taxes	17.9%	31.7%	48.3%
Corporation Taxes	17.2	44.8	35.9
Consumption Taxes	64.8	21.4	13.1

Note: Where percentages do not add to 100%, some panelists did not respond to this question.

FIGURE 6
Inflation Threats and Possible Controls
(By Geographic Region)



Monetary Policy. Despite the periodic concern of economic overheating, a majority of the panel (69.7 percent) do not expect a return of runaway inflation. Only a fourth of the respondents expressed concern, and a few (5.5 percent) had no opinion.

If inflation becomes a threat, however, 80.7 percent of the respondents believe interest rate controls can be used effectively to control it. Because inflation is not an immediate threat, they thought the discount rate (and interest rates) need not be raised. About a fourth of the panelists believe that inflation is a threat and that the discount rate should be raised to curtail it.

Only a few panelists fear high inflation. Most believe interest rates can effectively control run-away inflation. Respondents from Middle Tennessee are more confident than those from East or West Tennessee that the return of high inflation is not a threat (Figure 6 A). They are also less confident that interest rate control is effective (Figure 6 B). The perceived need for a rate increase to control impending inflation is similar in all areas of the state (Figure 6 C).

Among the industrial sectors, finance is the most confident that worrisome inflation will not return soon (Figure 7 A) and most confident that interest rate control is an effective restraint (Figure 7 B). At the other end of the range is the "other" category of industries, with 35.3 percent of the panelists believing that inflation may soon become a problem. Least confidence in interest rate as a means of control is expressed by the manufacturing sector. Finally, the manufacturing sector would be the first to call for a further rise in the discount rate if inflation threatened (Figure 7 C).

Political and Social Responsibility for Federal Deficits. Legally the Administration and Congress are responsible for fiscal and monetary policies that serve to determine the national financial health. While these two arms of the government establish fiscal and monetary policy, it is often alleged that powerful interest groups act independently or use their influence on public officials to gain certain advantages. The panel believes that financial health is not advanced by bulging deficits. Thus panelists were asked to rank the Administration, Congress and several influential groups as to their influence on deficit policy.

Not surprisingly, Congress and the Administration were assigned the primary responsibility because of their legal status. Over four-fifths (88.2 percent) of the respondents ranked Congress first or second (Table 3) with the Administration lagging far behind at just over one-third (37.5 percent). Individual voters were represented as having little clout, but voter groups representing those receiving large government entitlements (aged, welfare, etc.) and federal agencies representing special interest groups are considered significantly influential. "Social organizations" and "Federal Agencies" are ranked 1, 2, or 3 by over two-fifths of the respondents. Congress and the Administration are widely criticized for not resisting the pressures of private and semi-private organizations. Neither labor nor business groups were highly regarded for influencing the deficit budget tendencies. The respondents recognize that Congress and the

FIGURE 7
Panelists' Responses to Inflation Threats and Possible Controls by Industry (By Sector)

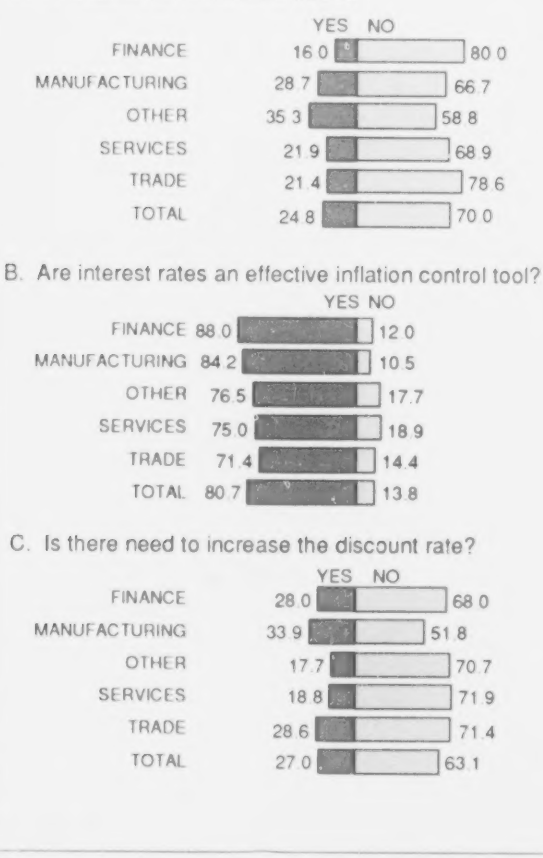


TABLE 3
Groups Perceived as Most Influential in Budget Deficits

Rank	Group	Percent of panel ranking group*	Score*
1	Congress	95.8	260
2	Administration	51.4	99
3	Federal Agencies	45.9	70
4	Social Organizations	42.4	66
5	Labor Organizations	27.1	44
6	Business and Industry	22.9	35
7	Individual Voters	14.6	25

*Each panelist selected and ranked the top three most influential groups. Score is the weighted average of these responses.

Administration are legally responsible but place some blame on other agencies because of the inordinate pressure brought on public officials.

There are still too many "pork barrel" bills. Even defense appropriations are passed when the Congress members think such bills will benefit their home states. **Manufacturer, Middle Tennessee.**

Because of entitlements, the size of government continues to grow. The Congress always spends more, after taxes are increased, instead of reducing the deficit. **Business Leader, East Tennessee.**

Panelists from all areas of the state place the responsibility for the deficit squarely on Congress and the Administration. Finally, a ranking by industry shows only minor differences--respondents in the trade industries assign less influence to the Administration and to business and industry groups than do other industries.

PART II
TENNESSEE CONCERNS

Economic growth is usually measured in terms of business and industry investment, more jobs and higher incomes. Production takes place primarily in the private sector, but the state is a partner in the process, since it is expected to maintain and encourage conditions favorable for growth. The state efforts are often criticized for ineffective administration or for not utilizing the most effective tools.

Part II of the questionnaire focuses on state programs that promote economic growth. Growth depends on a highly educated, trained and motivated work force (education system) and conditions favorable for capital accumulation and utilization (communication and transportation systems, especially).

The Economic Environment

The panel was asked to respond to a series of questions relating to the state's role in setting a favorable growth posture. The respondents were asked to rank several variables with respect to economic growth potential. The variables centered on state support for education and for the necessary communications and transportation infrastructure, since most fiscal and monetary controls are largely outside the ability of the state to influence. Responses are detailed in Figure 8.

The panel believes that basic K-12 education is a high priority item, but panelists are not convinced that more equality in per pupil expenditures or full state financing is critical to economic growth. Continued state activity in seeking investment from either foreign or domestic sources and more state-local cooperation were highly favored. Other recommended policy alternatives for state posture include a better transportation network (air, highway, railroad, water) and improved basic education and research. Also, a majority would approve of increased effort in the communications system (to facilitate movement of ideas and information by high capacity, voice, data, and video transportation). However, full state financing of K-12 education and more equalization are not considered critical to the growth posture, notwithstanding any equity considerations.

While a few regional and industrial differences are observed, the responses by region and industry are fairly close to the state averages.

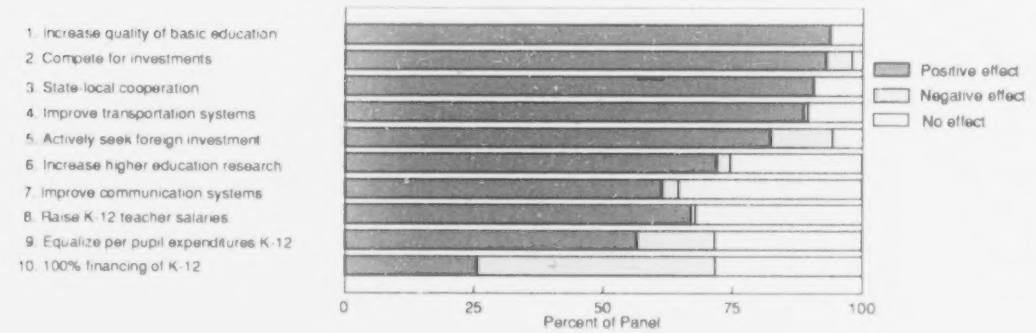
Education: Equality and Quality

In an additional question, when asked if they favored per-pupil equalization in K-12 expenditures by increasing assistance to low-ability districts, the respondents were fairly evenly divided (Figure 9). The equal division held whether there were more funds to assist low-ability districts without decreasing aid to high ability districts (with possibly higher state taxes) or whether the currently available funds were redistributed on a more equalizing formula. In effect, 45 percent of the respondents favor equalization and 45 percent would not favor equalization.

Money alone will not solve the problem. We need a program that equalizes the quality of teachers in poor counties. We need to get behind Alexander's program for better schools. **Trade Executive, East Tennessee.**

Each *area* is responsible for the education of its students. Why should one area of the state be responsible for the education of some students in another? The state should help subsidize pay of all teachers so we can attract and keep good teachers to better educate all the students. **Manufacturer, West Tennessee.**

FIGURE 8
Panel's Opinions of Effectiveness of Policy Alternative
on State Economic Environment



All educational opportunities should be equal. Some areas of our state have different problems that will not be solved with just money. **Manufacturer, Middle Tennessee.**

A final question in Part II deals with the Better Schools Program introduced in 1986 in which K-12 teachers were encouraged to improve their performance by the offer of merit salary increases. Over half the respondents believe that the program has improved the quality of K-12 education (Figure 10). A clear majority of the panel feels that the status of the teacher in the community has improved as a result of the program. The panel was nearly evenly split on the issue of improvement of teacher morale with about 40 percent responding *yes*, 28 percent *no*, and one-third, *no opinion*. In their comments many respondents offered the suggestion that the move was in the right direction but needed time and refinement before real improvement could be expected.

As in other professions, superior teachers should receive pay according to their skills and dedication. Though not perfect, this program does recognize these better teachers. **Manufacturer, West Tennessee.**

The improving test scores of Tennessee students support the positive effects of the program. This is the right direction, but there is still a long way to go. **Manufacturer, East Tennessee.**

I think it is still too early to evaluate the effect in the education system by the Better Schools System. The effect on some teachers has been positive. We must continue the effort. **Manufacturer, Middle Tennessee.**

FIGURE 9
Panel Opinions on Per-Pupil Equalization, K-12 Expenditures

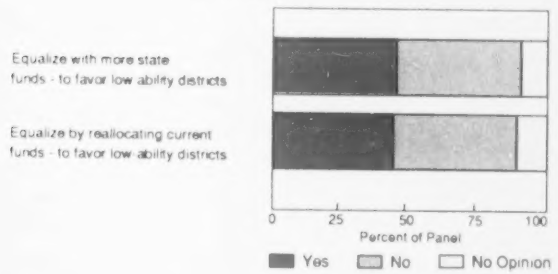
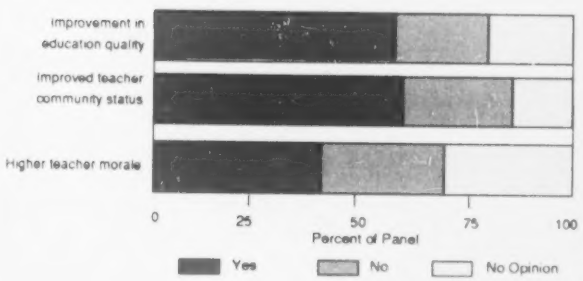
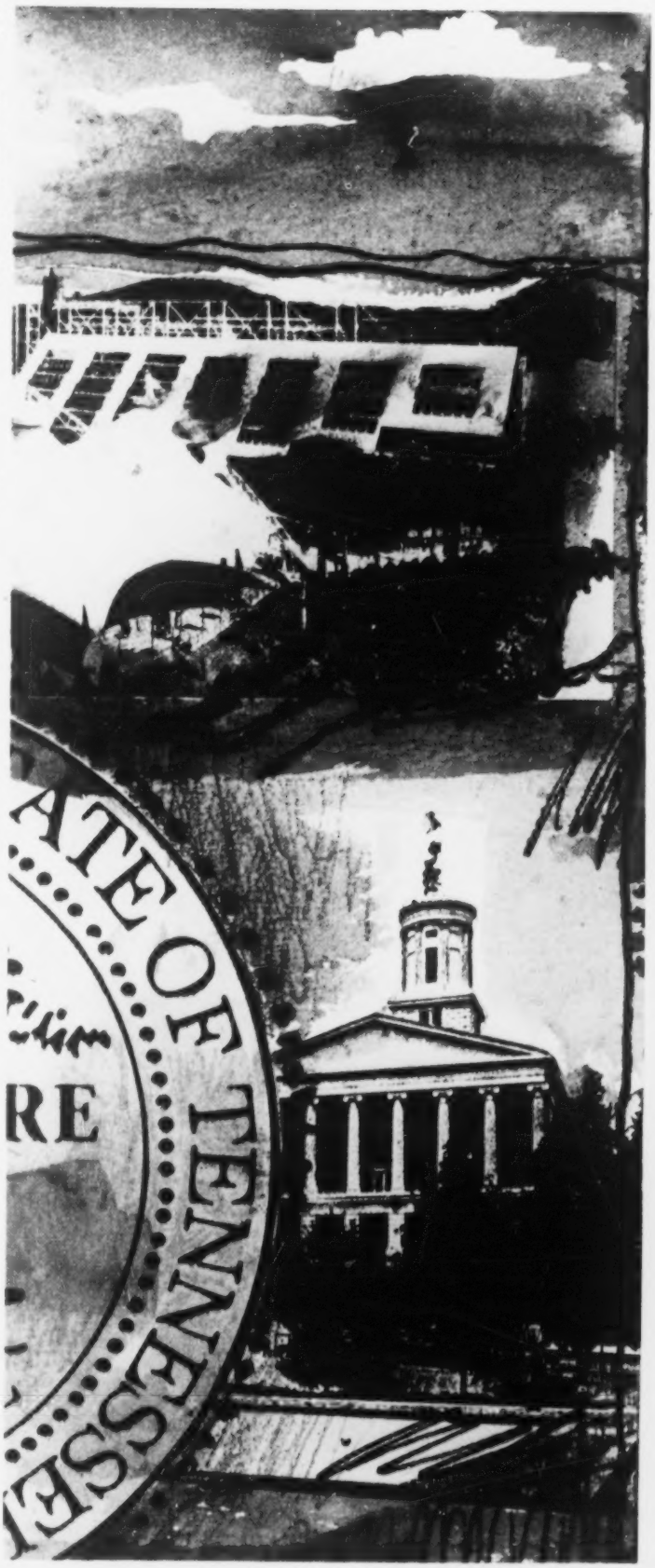


FIGURE 10
Panel Evaluation of Results of the Better Schools Program





PART III
ECONOMIC OUTLOOK SUMMARY FOR 1989

While Outlook panelists are cautiously optimistic about the Tennessee economy in 1989, they are less optimistic about the national economy in 1989 as compared to overall economic performance in 1988. Figure 11 shows that about 55 percent of the panelists expect both the state and national economies to be about the same in 1989 as in 1988.

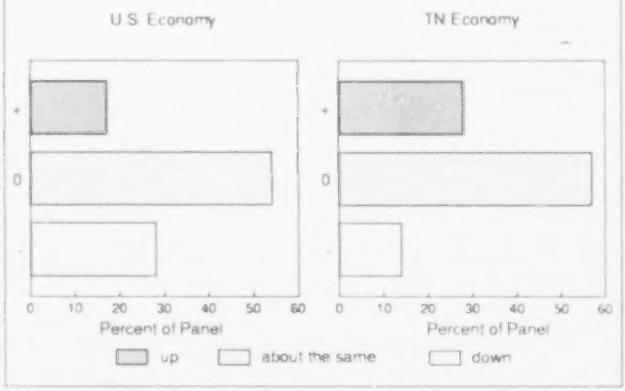
More panelists express optimism about Tennessee in 1989 relative to 1988 (28 percent) than expect a dip (14 percent). For the U.S., the panel's tilt toward pessimism is by an almost identical margin--28 percent expect the U.S. economy to be worse than in 1988, compared to 17 percent expecting improvement.

Outlook by Geographic and Business Sector

A closer view of the geographic and business sector attitudes toward the 1989 economy is shown in Figure 12.

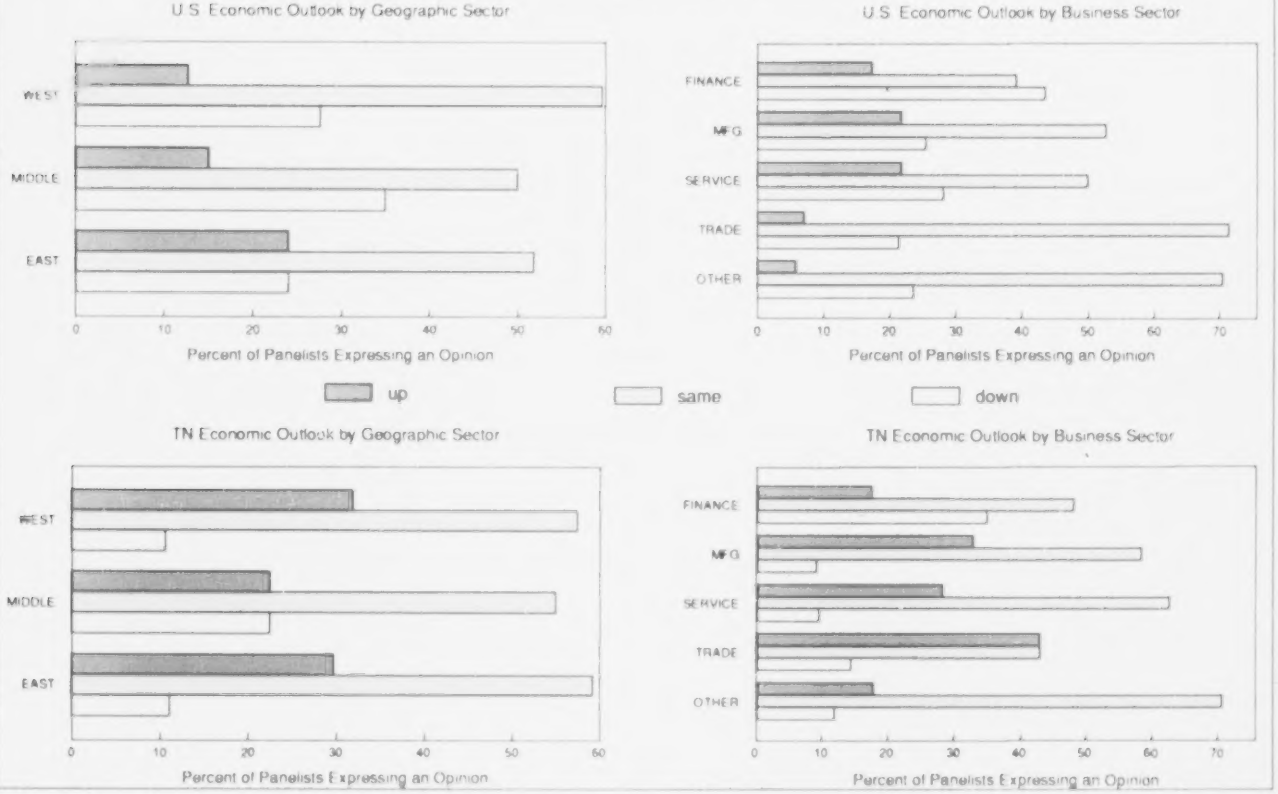
Geographically, Middle Tennessee panelists are the most pessimistic about the U.S. economy, while East Tennessee optimism/pessimism is evenly split. West and East Tennessee executives are the source of optimism toward the state economy.

FIGURE 11
1989 Expectations for Tennessee and U.S. Economy
As Compared with 1988



In an evaluation of responses by business sector, the finance sector executives are the only group with the dominant view that the U.S. will be down from 1988 levels this year. More than 70 percent of the panel representing trade and other business sectors expect the national economy in 1989 to be about the same as 1988.

FIGURE 12
Outlook Panel Views by Geographic and Business Sectors



In considering the Tennessee economy, manufacturing sector executives, who make up about 40 percent of the total panel, are the source of relative optimism. Nearly 60 percent of the panel anticipate no change going into 1989, and about 33 percent anticipate improvement in Tennessee in 1989 compared with 1988. Trade panelists are the most optimistic about 1989, while the finance sector group are the most pessimistic.

Following is a representative sample of panel views on the overall state economy. Additional panel commentary grouped by geographic sector is included in "State of the State" on pages 22 and 23.

Tennessee's outlook for 1989 is about the same as 1988; however, unless there are major shifts in Tennessee's education system we will not be able to compete in the labor force with other countries or states. The drop-out rate is much too high and individual systems do not have the resources to correct the problems. The state's economic development department offers no incentives for those who are attractive and could compete; their efforts are directed to the less developed countries which have the worst educational systems. **Business Executive, East Tennessee.**

The overall economy is heading for a recession--if not in 1989, early 1990. We are living on foreign investments in this country and when these slow or stop, we as Americans will have to accept a much lower standard of living. **Manufacturer West Tennesseee.**

Do not expect any significant changes from 1988. There is generally a lag following U.S. downturn; thus Tennessee has another year. Expect regional growth to vary, more in West Tennessee (Memphis area), flat in Middle Tennessee, and up in East. **Business Executive, Middle Tennessee.**

Tennessee's strongest point should be and could be a well qualified and highly cooperative work force. This is hindered by the fact that many of the available people have gone through the public schools and are still illiterates and that the numbers coming out of our public schools are increasing in this category. This presents a great problem for the present and for the future, but it also presents a great need for improvement of the condition. Many of our schools offer a wide range of subjects that are easy for both teacher and student but provide little preparation for the job market. One good example is the small number of persons taking chemistry and physics. Even greater is the lack of ability to read and comprehend or to create mentally and to put those thoughts into coherent written form. **Service Sector Executive, West Tennessee.**

This whole country needs a reeducation concerning the value of doing quality work. **Service Sector Executive, East Tennessee.**

1989 should be a banner year for state agri-businesses. Farm prices will be significantly higher due to actual and perceived efforts of this past summer's drought. Farm income and banking relationships will allow for expansion, equipment purchases and life style improvements for farm families and related industries. **Manufacturer, West Tennessee.**

PART IV
KEY ECONOMIC ISSUES FOR 1989

The panel was asked to review and evaluate 19 issues of potential economic concern in Tennessee, to record their expectations for each issue in 1989 relative to 1988, and then to rank the five issues of greatest concern to them in 1989.

Table 4 shows the potential problem areas ranked according to the score each received. The score is the sum of weighted ranks for each issue. Also shown is the percent of the panel that selected the issue among their top five.

TABLE 4
Potential Economic Problems
Ranked by Importance to Tennessee in 1989

Rank	Issue	Percent of panel selecting issue*	Score
1	Scarcity of skilled workers	69	259
2	Costs increasing faster than revenues	45	140
3	Interest rates on loans	42	135
4	Ability to attract and keep competent managerial personnel	36	112
5	Demands for wage rate increases	39	104
6	Supply of capital investment funds	30	98
7	Labor-management cooperation	31	86
8	Level of new residential construction	24	73
9	Inadequate consumer demand	17	53
10	Level of commercial-industrial construction	19	48
11	Cost of energy	17	47
12	Underutilization of plant capacity	17	46
13	Unemployment	16	46
14	Business-state government cooperation	15	42
15	Supply of transportation services and logistics support	15	41
16	Consumer price level	15	40
17	Excessive state and local taxes as percentage of personal income	12	29
18	Supply of short-term working capital	12	29
19	Availability of energy	7	1

*Each panelist selected five issues.

Four of the top eight issues relate to labor concerns:

Issue No. 1. *Supply of skilled workers*
Issue No. 4. *Ability to attract/keep competent management*
Issue No. 5. *Demands for wage rate increases*
Issue No. 7. *Labor-management cooperation.*

Three others relate to overall profitability:

Issue No. 2. *Costs increasing faster than revenues*
Issue No. 3. *Loan interest rates*
Issue No. 6. *Supply of capital investment funds*

Detailed panel responses to the top eight economic issues is shown in Figure 13.

1. Supply of Skilled Workers (score = 259)*

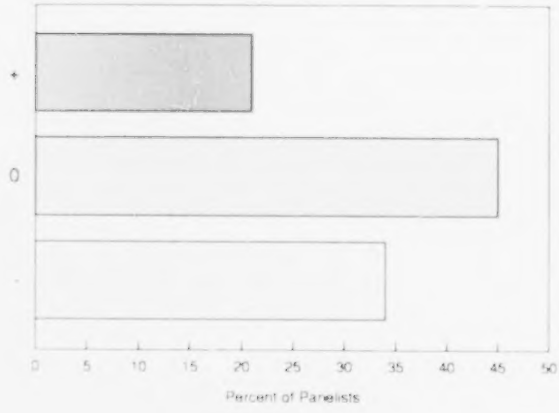
Ranked as the number 1 economic problem facing Tennessee in 1989 is the supply of skilled labor. An indication of the extent of agreement among the panel is the score of 259--nearly twice that of the second-ranked issue. Forty-five percent of the execu-

*The score shown after each issue is the weighted response of all panelists considering the list of potential economic problems. It is included to indicate the relative importance of the issues.

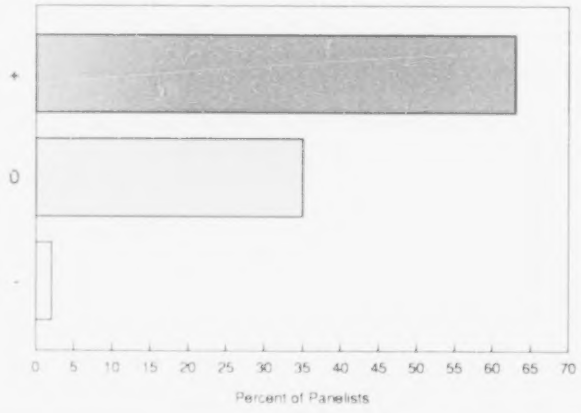
FIGURE 13

Critical Economic Concerns in Tennessee: Ranking And Expected Performance In 1989 Compared To 1988.

1. One -third of the panelists expect a decrease in the supply of skilled workers--the most critical issue in 1989.

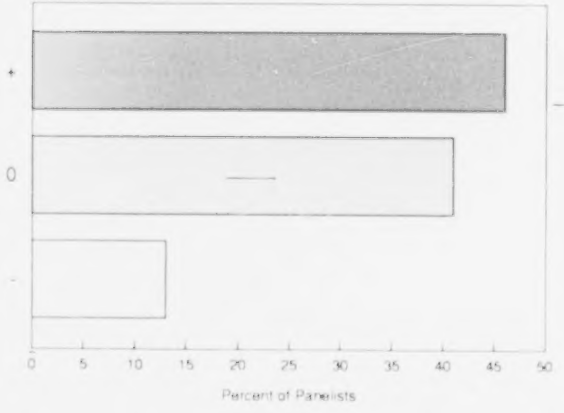


2. Increased pressure on profit margins in anticipated for 1989.

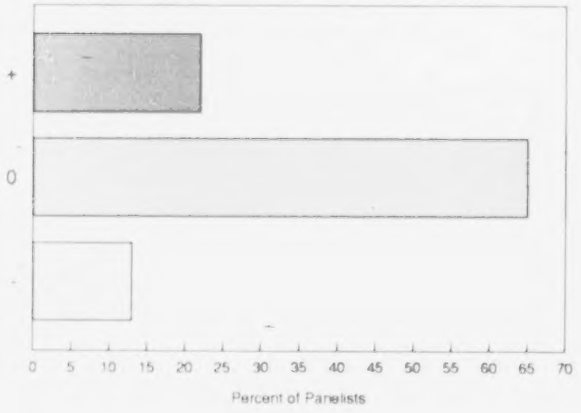


up about the same down

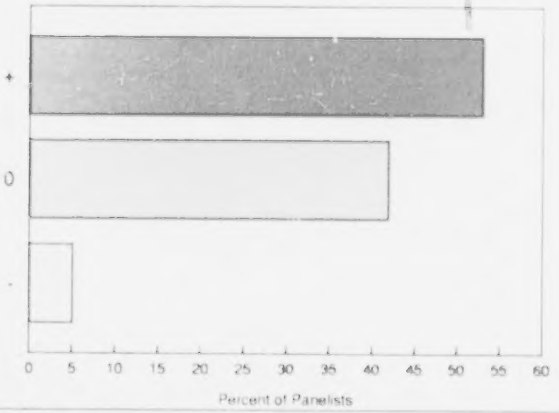
3. Interest rates on loans are expected to be at the 1988 level or greater in 1989.



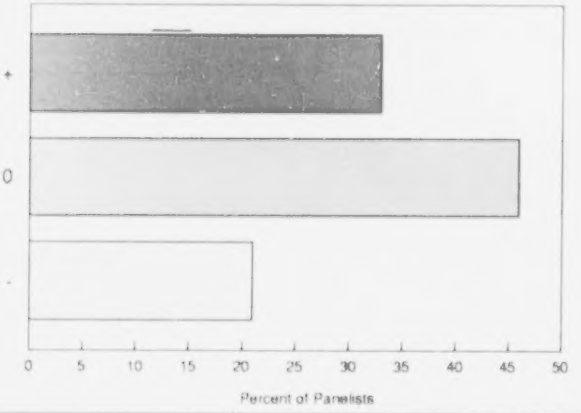
4. Little improvement is foreseen in Tennessee's ability to attract and keep managerial personnel.



5. Increased demands for wage rate increases are expected by a majority of panelists.



6. Panelists are divided in the expectations for the supply of capital investment funds; yet they consider this a key issue for 1989.



tives believe that the supply of skilled labor will be about the same in 1989 as in 1988, while 34 percent expect that supply will be down from 1988 levels. See issue number 1 in Figure 13.

Nearly 70 percent of the panelists selected skilled labor supply as one of the five most critical issues. It was the only issue so designated by more than 50 percent of the panel. Supply of skilled labor has ranked in the top three problems every year since 1985.

Our problem is our poor school system--our lack of basic skills (reading, writing, math). We must require that students are not promoted from grade to grade unless they qualify. Business persons must become involved (Adopt-a-School, Knoxville Chamber of Commerce (schools) program etc.) **Retail Trade Executive, East Tennessee**

The large percentage of untrained people with limited education is a tremendous burden to carry and is not a problem industry will overlook in considering a move to or expansion in Tennessee. **Financial Executive, West Tennessee.**

Investment in the quality of our human resources is, in the long run, our only hope for progressive and continuing economic development. The strength of public education works in the best interest of the total community and must be our number 1 priority. **Service Sector Executive, West Tennessee.**

We must improve higher education standards in high-tech areas. **Finance Executive, Middle Tennessee.**

Neither competent nor skilled workers are available. The Tennessee unemployment rate of 5.9 percent with few exceptions represents the chronically unemployed with very little intent to become and remain employed. Workfare incorporated into the welfare programs is a partial solution. The Jobs Partnership Training Act will help some, but it would aid considerably more if properly administered. **Manufacturer, Middle Tennesseec.**

Availability of skilled labor has been an issue within the state for many years. If we are to increase per capita or household income, we must build a more skilled labor force in order to attract higher paying jobs. This requires continued emphasis on improving the quality of education. Results will be several years in coming, as education is a long-term issue. **Banker, Middle Tennessee.**

With the age of information upon us and the large number of people who can't even read or write (some 80,000 to 100,000 in Memphis alone) the demand for skilled workers will outpace the supply unless we can correct this basic problem. **Service Sector Executive, West Tennessee.**

Most individuals in the general work force do not recognize the value of "crafts." It is the misfortune of today's market that individuals do not attempt to grow and develop within a trade. The skilled craftsman develops his abilities over application of the trade. Today's work force is not willing to pay the price early, then yield that investment in the future. **Manufacturer, West Tennesseec.**

Skilled workers in specialized areas of health care are becoming harder to recruit and retain because of shortage of qualified applicants. The recruitment from high schools by appropriate educational facilities would increase awareness of future employment for young people. **Service Sector Executive, East Tennessee.**

2. Total Costs Increasing Faster than Revenues Received (140)

Over 60 percent of Outlook 89 executives expect increased pressure on profit margins in 1989 as compared to 1988. See issue number 2 in Figure 13. There was a greater consensus among panelists on this issue than on any other issue.

Any slowdown in the economy, coupled with demands for higher wages and higher costs of materials, will have a negative impact on productivity and production costs. **Business Executive, East Tennessee.**

Inflationary pressures continue to cause costs to increase faster than revenues. This is prompted in large measure by the continually increasing national debt. New or changed strategies which could favorably impact on the deficit are highly unlikely by the new Administration in its first year. Since higher interest rates compound the deficit, immediate action by the Federal Reserve Board should be taken to stabilize interest rates at no more than present levels until effective actions can be taken to reduce the federal debt. **Consulting Engineer, West Tennessee.**

Nonproductive costs of doing business continue to climb. Bureaucrats establish rules and regulations without regard to costs. Most rules and regulations directly affect the ability of U.S. companies and workers to compete at the international level. We cannot have the best of both worlds. **Business Executive, East Tennessee.**

1989 will be a seller's market. Suppliers will raise their domestic prices and sell overseas or offshore. Stop the devaluation of the dollar. **Manufacturer, West Tennesseec.**

While revenue/cost productivity relationships have improved the last few years, it is still the key to the long-term economic health of our economy. A continuing emphasis and understanding between owner, labor and government is the key. **Financial Consultant, Middle Tennessee.**

3. Interest Rates on Loans (135)

Forty percent of the panel expects interest rates on loans to be the same in '89 as in '88, and 47 percent expect them to be higher.

Higher interest rates will cut construction and affect the purchases of high-ticket items. This of course would then affect employment and wages. **Manufacturer, West Tennesseec.**

Cost of capital is vital in growth and expansion--it edged up in late '88. The 10 percent rate is a "magic" line that slows growth, home building, etc. A small reduction in prime would have a positive effect in '89. **Utility Executive, East Tennessee.**

The biggest economic problem in Tennessee (as well as the U.S.) is that real interest rates are too high. High real interest rates transfer income and net worth from people with high propensities to consume to people with low propensities to consume. This reduces economic growth and puts pressure on people who have loans. **Financial Sector Executive, West Tennessee.**

A high interest level has a dampening effect on almost all economic activity -- new home construction, commercial construction, new business starts. The main means of correcting high interest rates consists of eliminating federal budget deficits and thus reducing that tremendous boost to interest rates. **Attorney, East Tennessee.**

4. Ability to Attract and Keep Competent Managerial Personnel (112)

The majority of panelists clearly believe that this dimension of the labor issue will be little improved in 1989.

I have placed both management personnel and high-level technical personnel in my first choice. Key management staff are difficult to find and keep. Tennessee serves as a training ground for this level person, but they will be transferred to corporate jobs elsewhere when the training is complete. **Service Sector Executive, East Tennessee.**

Leadership is the key to growth. It is also the key to having an active vibrant local infrastructure in our communities. We cannot and should not build up costly institutions of mediocrity in local government. Unfortunately, the educational environment of Tennessee forces our best and brightest to leave. **Manufacturer, East Tennesseec.**

I believe Tennessee is a net exporter of its most talented young people. We need to have enough jobs and challenges here to become a net importer. One of the hardest tasks in trying to recruit "top managers" is to convince them to consider Tennessee. Once they get here, they usually like it. **Manufacturing Executive, East Tennessee.**

5. Demands for Wage Rate Increases (104)

The majority of panelists expect wage rate demands to increase in 1989 as compared to 1988, and less than 5 percent foresee any decrease in wage rate demands. A Manufacturer from Middle Tennessee offers an explanation:

Low inflation of the recent periods create pent-up demands that must be dealt with--increases in the past (due to inflation) are now viewed as a right (expected), regardless of the real economic situations.

6. Supply of Capital Investment Funds (98)

Forty-six percent of Tennessee business leaders responding to the 1989 Outlook survey expect the supply of capital investment funds to remain the same in 1989 as 1988. Only a third of the panelists expect improvement in this important area. A Service Sector executive from West Tennessee explains why he ranked this issue as the most important one facing Tennesseans in 1989:

All small towns in the U.S.A. have a shortage of venture capital. Unless we solve this problem, small towns will grow only as the larger corporations choose to locate or expand there. Small, high-risk new companies are where the new jobs of the future are, and without venture capital, we are lost.

7. Labor-Management Cooperation (86)

A majority of panelists think that labor-management cooperation will remain the same as last year. However, the importance of this issue rests in the minority responses. Twenty-one percent look for decreases in labor-management cooperation, while 16 percent expect advances in this area. Moreover, many panelists view the importance of labor-management cooperation in terms of the level of union activity, while others see the potential of new management styles. Two West Tennessee manufacturers shared their views on this issue:

When union organizing activity begins in a community, industrial development stops. The unions have targeted Tennessee and are active across the state. I doubt they will be successful, but if they are, it means curtains for more plants locating in those areas. It is the kiss of death for industrial development.

Labor-management cooperation will overcome the other critical problem areas and in most companies is an untapped resource. Management must be held directly responsible for the bottom line, and labor must participate in both the direction and operation results in good times and bad.

8. The Level of New Residential Construction Activity (73)

A little over half of the respondents expect residential construction to decline in 1989 relative to 1988.

Nashville, Knoxville, and other major metropolitan areas have an excessive inventory of single family residences. It may take two or three years to work out this problem. **Banker, East Tennessee.**

It is noteworthy that each economic issue shown in Table 8 was chosen as the most critical issue by at least one Tennessee business leader. Average weighted response varied from 259 for "scarcity of skilled workers" to one for the "availability of energy." Issues ranked 9 through 19 received scores of 53 and lower.

PART V
PATTERNS OF USE AND SOURCES OF INFORMATION

by Paula Kaufman and Angie LeClercq

Externally-generated information comes in many guises. Stockbrokers rely on Dow-Jones online stock quotes, financiers on company ratings and financial ratios, engineers and architects on industry standards, manufacturers on patents and demographic data, and lawyers on digest and reporter systems.

Organizations cannot be effective in a state, national, and global economy without having prompt and cost-effective access to complete, accurate, and relevant information. This information is often critical in the decision-making process. In fact, information is often so critical to an organization's success that ownership of information becomes exclusive and proprietary. For this very reason, the major television stations commission the Nielsen Reports for their exclusive use.

In this year's survey, we asked respondents to comment on the value of externally-generated information, i.e., information obtained from sources outside the organization. Our survey indicates that success, power, and profit are all inextricably interwoven with information access and control. The results are described in greater detail below.

Externally-generated information is clearly important to the successful operation of business and industry in Tennessee. Sixty percent of respondents to the Economic Outlook survey found it "extremely" or "very" important, and 26 percent found it "important."

As might be expected, externally-generated information is more critical to some organizations than others. Figure 14 shows this perceived difference by type of firm -- finance (includes insurers, banks, stockbrokers, and investment concerns), manufacturing (product manufacturing, including paper, wood products, electronics, metals, tool and die, etc.), service (law firms, advertisers, consulting, market development), trade (retail concerns: produce, food service, hardware, furniture, drugs, fashions), or other (government, utilities, or newspapers). Comments on the importance of information included the following:

FIGURE 14
Panelists' Ranking of Value of Externally-generated Information to Successful Operation of Organization (Percent by Sector)

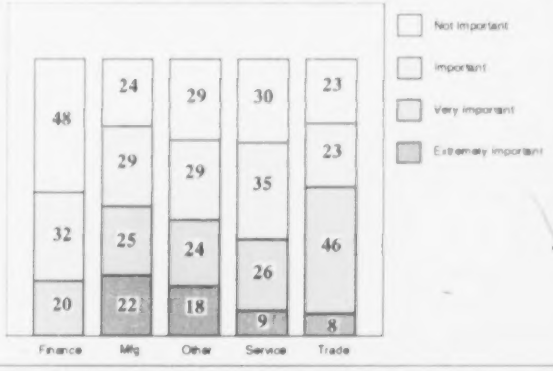


TABLE 5
Frequency of Use of Externally-Generated Information (Percent by Percent)

Sector	Daily	Weekly	Monthly
Finance	84	8	4
Manufacturing	57	14	10
Other	52	17	6
Service	71	6	16
Trade	57	21	14

We listen very carefully to all information that is out there. It is part of everyone's job. **Service Sector Executive, East Tennessee.**

It is not possible to know too much. **Manufacturer, East Tennessee.**

Patterns of Information Use

Use of external information pervades the daily lives of most executives. Sixty-four percent use externally-generated information on a daily basis, and 22 percent, on a weekly basis. Surprisingly, 13 percent use such information only on a monthly basis. The differences in amount of use vary dramatically by type of organization, as Table 5 shows.

But just who is using this information? The old adage that knowledge is power is reinforced out by our survey. Critical information is the domain of the decision-makers--the chief executive officers and senior executives. Thirty-four percent of all businesses ranked their CEOs as the primary entry point for information into their organizations (see Figure 15). This tendency of concern for information is noted in one comment:

There is a high degree of awareness by all involved as to dynamics of our market, competition, and technology. **Service Sector Executive, East Tennessee.**

Sources of Information

Organizations rely on a plethora of sources for their critical information. As might be expected, however, print sources--be they trade magazines, *The Wall Street Journal*, newsletters, consultant mailings, technical bulletins, or sales reports--constitute the "heavy" reading of most business people. Almost 90 percent indicated that they used printed materials to get this information. Printed materials also come from "for-profit" vendors and/or consultants and purveyors of information services and are available directly by purchase or in public libraries. Fifty-five percent indicated that they used information services as a source, while only 10 percent used the public library. Notably, 24 percent of the Tennessee businesses surveyed have their own in-house libraries. Clearly, the cost of acquiring information resources directly is well worth the savings in time needed to go to other agencies.

Given the rapid spread of computer technology, it is interesting to note that online sources are used by only 20 percent overall. However, in the finance industry, in which there is a plethora of computerized information sources, the use rate doubled the overall average (at 40 percent). The importance of consultants in providing external information is also of note. Overall, 34 percent of those responding use consultants, with trade associations registering the highest use rate, at 43 percent. The full range of sources and their relative use by organization type is illustrated in Table 6. Finding the relevant source is crucial, as one commentor noted:

Our economic lives depend upon absorbing the onstant flow of external information available to us. The biggest problem is discerning which elements of the available information are important and which are not. **Service Sector Executive, East Tennessee.**

FIGURE 15
Panelists' Ranking of Entry Points
For External Information Access

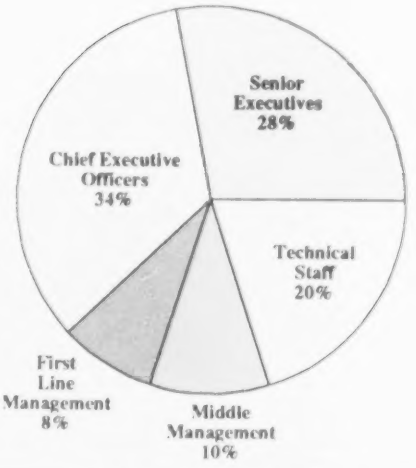


TABLE 6
Sources Used by Panelists to Obtain Information
(Percentage of Panel Using Each Source)

Sectors	Print	Books	In-house Library	On-line Databases	Computer Tapes	Consultants	Public Library	Information Services
Finance	96	40	20	40	20	36	12	60
Manufacturing	89	62	18	12	9	37	9	54
Other	94	68	43	6	6	25	13	62
Service	84	61	32	32	10	29	13	52
Trade	85	42	14	7	7	43	0	50
AVERAGE	89	57	24	20	11	34	10	55

Costs of Information

Information is a valuable commodity. The general public may consider that it is a "free" commodity. However, the timeliness, accuracy, completeness, and exclusivity of information are important in giving business organizations a critical competitive edge. Hence, many businesses are willing to pay dearly for information. Nine percent spend between 5 and 7 percent of their organization's annual operating budget on the acquisition of externally-generated information, and 2 percent spend between 8 and 10 percent. However, 81 percent report that they spend 4 percent or less of their budgets on external information. The cost of information varies by type of organization, as illustrated in Figure 16.

TABLE 7
Factors Considered to be Barriers to Information Access
(Percent by Sector)

Sectors	Cost	Lack of Information	Uninformed Sources	Inadequate Staff	No Barriers
Finance	28	20	8	40	36
Manufacturing	29	35	31	22	43
Other	13	46	6	46	40
Service	32	10	6	29	42
Trade	35	25	16	21	57

FIGURE 16
Panelists' Estimate of Percentage of Annual Budget
Allocated to Externally-Produced Information
(Percent by Sector)

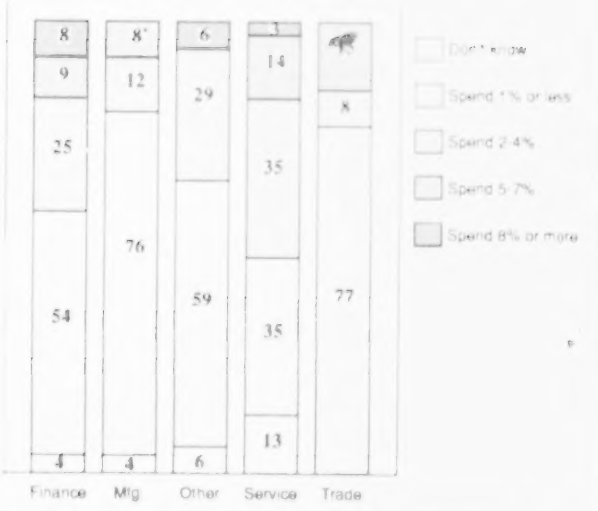
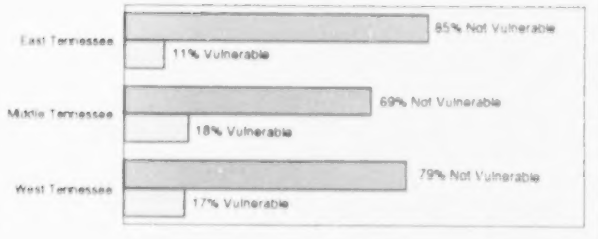


FIGURE 17
Panelists' Assessment of Vulnerability
to Lack of External Information
(By State Division)



If information means power and money, then most of the competitors will leap all hurdles to win the prize. It is not surprising, then, that many of the players--42 percent --stated that there were "no barriers" to gaining access to the information they needed. Despite this optimism, roadblocks to access were noted. Twenty-nine percent of the sample checked "cost"; 29 percent, "don't have staff to receive and prepare the information"; 25 percent, "don't know what's available"; and 16 percent, "don't know where to find the needed information."

Perhaps those barriers noted reflect the fact that the information industry--accumulating, processing, storing, marketing information--is itself the county's largest business. Finding the right access points to that industry is no easy process. Perception of barriers varied by type of organization. Table 7 shows those differences. Businesses face the dual problem of too much and too little information, as several comments indicated:

It would be good to have more information, but there soon gets to be a cost-benefit problem. **Business Leader, East Tennessee.**

Information is there for the perseverant. **Finance Executive, Middle Tennessee.**

Optimism prevails in business, especially regarding those factors that a business person can control. A whopping 79 percent of respondents do not feel that their organization is vulnerable in its current and future environment due to the lack of external information. This optimism was shared across the three regions of Tennessee, as shown in Figure 17.

Finally, information is not an interchangeable commodity. Information to a manufacturer is a different creature from information to a lawyer. One deals in market analysis for nuts and bolts; the other is searching for the perfect clue or piece of evidence to make a winning argument. However, there are some common threads, as revealed by comments:

I am besieged with information--newsletters, offers, seminars, software--you name it. **Manufacturer, West Tennessee.**

Without adequate and accurate information our services do not have the quality needed. **Finance Executive, East Tennessee.**

We constantly seek it, and it's our business. **Finance Executive, Middle Tennessee.**

Our survey indicated that Tennessee organizations find information to be a strategic resource. Peter Drucker has said that "the productivity of knowledge has already become the key to productivity, competitive strength, and economic achievement." However, the ever-increasing glut of unorganized and uncontrolled information becomes an obstacle. Therefore, as author John Naisbitt noted in *Megatrends*, the emphasis must shift from the supply of information to its selection. Tennessee organizations are very much involved in that process of controlling the flow of information from receipt to profitable use. ■

1989 PANELISTS COMMENT ON

EAST

Retail Trade Executive: Generally speaking, the economic outlook for Tennessee is only fair. Efforts at attracting new industry are to be applauded; they have helped certain areas in the state, but overall there is no influx as has been the case in Atlanta, for example. Tennessee must make efforts to be responsive and accommodating to the needs of new industry and existing industry.

Perhaps the greatest obstacle to progress in the economic realm is the poor ranking of Tennessee's quality of education. Improving education will help the state reap long-term benefits in the decades to come. Tennessee has much to offer: a good year-round climate and natural beauty, location for many shipping and distributing concerns, and an economy that is not overbuilt, with room to grow.

Attorney: Tennessee's 1989 economic outlook appears stagnant. This year will be the foundation to begin improvement or lead to recession. Most of the future depends on what happens in Washington and in particular whether or not government is able to control the budget.

Retail Trade Executive: The year 1989 should show a slight improvement in the state economic outlook due to our probusiness attitude (e.g., Nashville's aggressive attitude for growth, along with local chambers of commerce). Our weakness is a lack of skilled labor as well as poor school systems in many counties. We also need better state and local support of the arts. The state needs to support economic development primarily in the major metropolitan areas. This means that those in poorer counties will have to drive to those areas for good jobs since high-tech industries will not go to the rural areas because they want better schools, arts, and the quality of life that only our largest metropolitan areas have to offer. The low unskilled jobs are going overseas.

Banker: It appears to me that we are developing two Tennessees -- one which consists of the major metropolitan areas and surrounding counties, another which is comprised of primarily rural or mountainous counties. The metropolitan areas should continue to be fairly strong, although Nashville may experience a temporary adjustment. The rural areas face major obstacles in adjusting to a restructured American industry and commerce which will be more information-based.

Banker: Tennessee's overall outlook for 1989 looks positive to me. Interest rates may slow growth if they are allowed to increase in order to slow inflation. To attract new industry we need a better educational system. The state should make education a number one priority, especially in the area of funding.

Utility Executive: The outlook for '89 is favorable. One strength is the over-abundant work force, but a major weakness is the lack of training adequate to meet needs of increasingly complex jobs. We are underutilizing the abilities of our young adults because we are unwilling to spend the money to better educate them. It may well be less expensive to educate them than to support unemployed or underemployed persons.

Manufacturer: I do not see Tennessee increasing its "market share" of revenues. Investing in programs that provide a trained, competent, drug-free work force will do more to attract industry than any kind of tax incentives.

Banker: Unemployment has improved in many areas of the state, but some areas need help. In the national economy all indications are that a slowdown is beginning; however, I believe that this will not lead to a recession and in general the economy should not suffer too much decline.

Business Leader: Banking in Tennessee is generally conservative. We need true commercial lending expertise, business expansion aggressiveness, and borrowing expertise to encourage business development and expansion. The solution is wide-open regional and national banking!

In the past five years our state government and institutions and business within the state have begun addressing the root causes of poor economic health: education, research, banking, venture capital, tax structure, etc. There are still many improvements to be made. Moreover, the return for many of the improvements already made are still yet to come.

MID

Manufacturer: Tennessee will need more revenues in 1989 to fund transportation/road improvement, cost of education, and state and local services, etc. The state legislature must also begin serious work in revamping the tax structure.

Tennessee is growing and becoming more prosperous. Industry is coming to Tennessee because of low costs, quality of life, and natural resources. As this activity expands the state must be prepared to grow with it economically. More planning and goal setting to solve these new problems must be set in place now.

Insurance Executive: Our outlook for 1989 is excellent. Our major assets remain location, our people, and good government. However, we must generate additional state revenue to provide better K-12 education, handle the increasing cost of Medicaid and improve and enlarge our prisons. I feel we cannot rely on further increases in the already excessive sales tax, but need to explore fully other tax bases -- including the politically unpopular state income tax, with some reduction in other taxes.

Business Leader: Many issues will arise in the 1989 legislative session, and the cost of operating a business in Tennessee will increase. The Administration to date appears oblivious to this problem. Continued increases in cost forced by government will make Tennessee much less attractive to new industry and development.

Still, Tennessee has many attractions. There will continue to be increases in industrial and warehousing capacity driven by locator primarily. If Tennessee's business tax unbalance and education deficiencies are not dealt with in the near future, we will cease to grow.

Business Leader: Industry (manufacturing and service) are dependent on skilled, trainable workers. Our first priority should be education. Our second should be to correct tax inequities. I don't believe a personal income tax is desirable or needed, but it would still be better and fairer than the present system. We now tax success and give failures a free ride. All business taxes are regressive -- no matter what kind.

THE STATE OF OUR STATE

DLE

The higher percentage of workers in manufacturing will probably cause Tennessee to lead the U.S. in a recession.

Manufacturer: Tennessee's non-agriculture industry has become heavily automotive-related in the past few years and I see 1989 as a down year in this business cycle. The same will be true for the construction industry. There is very little that can be done until consumer debt is brought into a more manageable position.

Trade Executive: Business in 1989 will trend down, construction will be weaker, and farming will rebound somewhat. Education in our state and even our nation must be improved immediately or our economy and our quality of life is going to decline.

Banker: Tennessee will experience a softening in its economy paralleling the expected softening in the U.S. Economy. This will result in a cautious consumer in terms of expenditures, while costs will continue to rise. Nashville is overbuilt in almost every area of real estate development (office, buildings, housing, etc.), and this will slow growth in Middle Tennessee for the next year.

Attorney: Last year and the year before, I felt that the trade and budget deficits were the most critical economic problem facing Tennessee, as well as the nation.

Although the nation may well have troubled times ahead during 1989, I feel Tennessee will be able to hold its own due primarily to its diversity of economic activities, its sound fiscal policies, and its more competent, dedicated, and enlightened leadership.

Manufacturer: Our commitment to excellence in education (K-12, higher education, centers and chairs of excellence etc.) is our greatest asset. The results will be evident as we move toward the 21st century. A state government and local government friendly toward businesses is also important, along with an improved transportation system (on the ground and in the air). Maintaining a good labor environment is our single biggest challenge. The Saturn hiring practice and the Nashville Project of the AFL/CIO reorganizing in Middle Tennessee threatens our good labor management climate. The Saturn hiring practice is in direct conflict to the spirit of our "right-to-work" law. As a businessman I am most concerned about this.

Manufacturer: Without capital investment funds, expansion will be limited, and expansion is the key to economic growth.

Tennessee's overall outlook is probably better than 75 percent of the other states. The influx of foreign manufacturers and expansion of American industry in Tennessee will give the state a major economic boost in the future. Agriculture also seems to be making a profit after so many years of economic disaster.

Finance Executive: Weaknesses in 1989 will come from construction, both commercial and residential, and retail sales will be poor, including automobiles.

Business Leader: I believe the major cities will continue to have strong economic growth. However, educating the citizens will need to be a top priority if we are going to meet the challenges of 1989 and beyond.

Business Leader: Investment in the quality of our human resources is, in the long run, our only hope for progressive and continuing economic development. The strength of public education works in the best interest of the total community and must be our number one priority.

There are a lot of things we just can't do much about. We need a continued string of "good luck," but some strategic things we can address. We have a state and local government fiscal crisis looming on the horizon. At the same time, education and other areas need more resources. Quality must be bought and paid for. We must address tax reform and move from a confused and regressive and inelastic structure that discourages capital investment to one that responds to and encourages economic growth.

Engineering Consultant: The economy in Tennessee is strong and will continue strong throughout 1989. It is characterized by low unemployment, stabilized energy costs and continuing large investments by U.S. and foreign industrial companies in new or expanding manufacturing facilities. The principal negative factor lies in the lack of low-cost housing and a general slowdown in new industrial construction.

WEST

Manufacturer: If the unions are left under control, 1989 could be a good year. Foreign investment in the state will help to create jobs. Skilled labor is and will continue to be a problem. Interest rates will be important for financing capital improvements. I feel good about the leadership in Nashville.

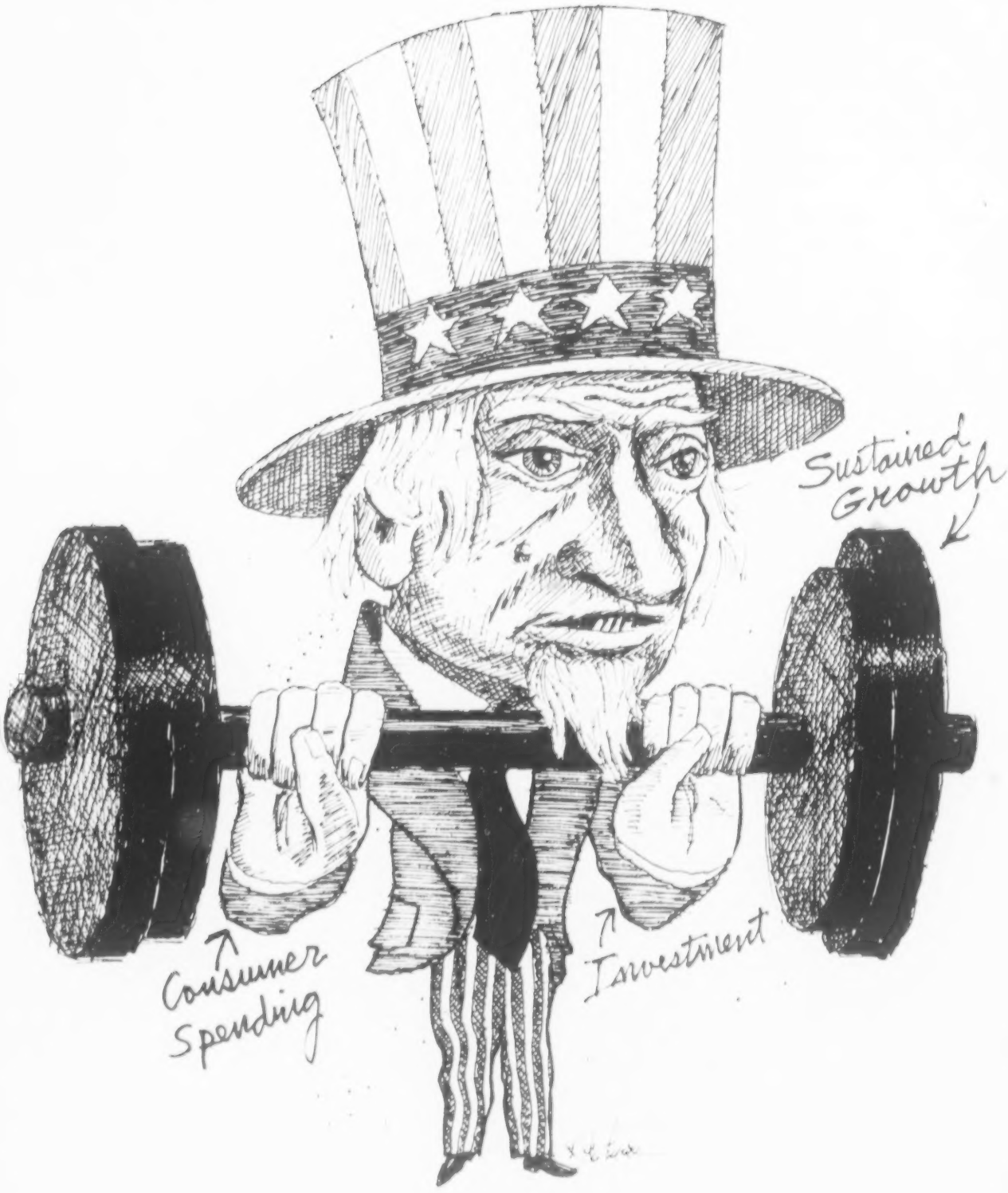
Manufacturer: High interest rates will reduce business investments in favor of investments in higher-yielding, interest-building securities. Also, borrowing for business investments will become more costly and reduce investments in plant and equipment.

Tennessee's overall outlook for 1989 appears good. We are continuing to attract major industries into the state such as Nissan and Kellogg. These industries will also attract other industry necessary for service and supply support. The road construction program is strengthening communities' ability to attract new industry.

News Media Executive: Roads in West Tennessee are critical to our ability to recruit industry development. Construction is underway but roads are 5-10 years from completion. The region is behind other Grand Divisions in the ability to use good transportation as a selling tool.

Tennessee is an attractive place to live; it retains a good image nationwide and is strategically located. The government is cooperative and basically efficient; however, rural areas suffer from poorly educated populations and we have yet to impress upon voters the significance of higher education standards to attract jobs of the 1990's. But we're hustling better than many of our southern neighbors, and this will pay off.

Manufacturer: After working with people over the last 38+ years in various states, I personally believe the greatest strength Tennessee has is in the outstanding work ethic of their people. Their determined will to achieve a goal is outstanding. Weaknesses lie in four basic areas in West Tennessee: 1) skilled machine shop personnel; 2) availability of class A motels; 3) availability of class A restaurants; and 4) availability of class A shopping areas. With these drawbacks, it is difficult to attract experienced management people.


Sustained Growth
Consumer Spending
Investment

THE U.S. ECONOMIC OUTLOOK

by John W. Mayo

The robust performance of the national economy is remarkable, given that world financial markets tumbled just over one year ago. If consumer spending and investment continue, the economy should experience sustained growth.

The importance of economic activity at the national level as a fundamental determinant of economic activity at the state level cannot be overemphasized. This is particularly true given the sometimes acute volatility of the Tennessee economy to moderate economic swings at the national level. In this article, we examine the performance of the national economy during 1988 and the prospects for future economic growth. The discussion here is intended to create a foundation upon which to better understand the likely path of economic activity in Tennessee.

To see the relationship of the national and Tennessee economies, consider Figure 1, in which we see that economic activity at the national level, illustrated by changes in real gross national product (GNP), and economic activity at the state level, illustrated by changes in gross state product (GSP), are closely related. Moreover, it is important to note that in periods of national economic downturn, Tennessee economic activity often retracts disproportionately; and during periods of national economic expansion, the Tennessee economy has generally out-performed the national economy.

A similar relationship exists for the pattern of unemployment at the national and state levels, as can be seen in Figure 2. Again note that the general pattern of state unemployment rates mimics that which occurs at the national level. As in the case of total economic activity, however, the unemployment patterns at the state level tend to be somewhat more volatile than at the national level. Some of the reasons for this discrepancy will be noted in later chapters. Here, the important point to bear in mind is that knowledge of national economic patterns and trends are very helpful in creating an understanding of the state-level economic outlook.

FIGURE 1
GSP vs. GNP

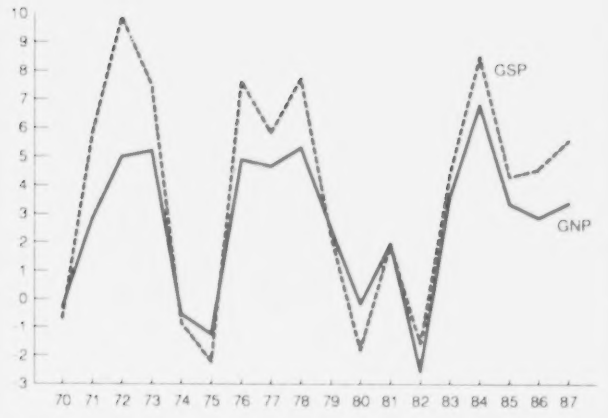
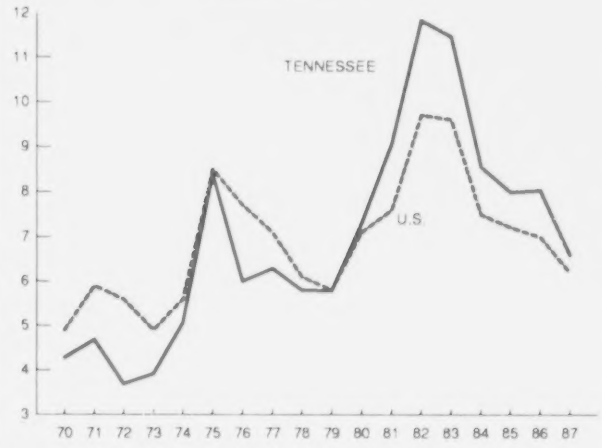


FIGURE 2
Unemployment Rates



1988: An Overview

Just over one year ago, the stock markets in the United States and other major industrial countries collapsed and our economic outlook for the United States was thrown into confusion. A number of fundamental questions surfaced in the weeks that followed the financial crash, the answers to which were thought to determine in large part the rebound capabilities of the U.S. economy. The questions ranged from whether and to what extent the practice of programmed trading contributed to the stock market collapse, to whether consumer confidence would be shattered by the apparent fragility of financial markets.

Given the significant uncertainty that surrounded the answers to these questions, we were very cautious in our forecast of economic activity for 1988. We anticipated that consumer spending would retrench, but by some uncertain amount in 1988; that investment growth would be moderate; that the federal budget deficit would fall slightly; and that the trade deficit would improve. In most respects the pattern of economic activity at the national level has followed rather closely the scenario we described last year. Investment growth has indeed been moderate, with aggregate growth of gross private domestic investment of about 10 percent for 1988.

The federal budget deficit has remained in the $150 billion range, well below the $200 billion deficits of the mid-1980s, but not on a downward path toward an eventual balanced budget. And the trade deficit has fallen during 1988. The one major surprise of 1988 has been the extraordinary resilience of consumer spending in the face of last fall's collapse of financial markets. In the wake of last October's stock market crash, consumers have continued to increase their purchases. Overall, economic activity at the national level has been very solid. Real, inflation-adjusted GNP will grow by approximately 3.9 percent for the year. Following is a closer examination of the individual characteristics that have led to this healthy growth rate of the national economy.

First, there was a surprising rate of growth in consumer spending during 1988. Depending on the final outcome of the all-important Christmas buying season, the growth in real (inflation-adjusted) consumer spending should be around 2.7 percent. While this is not in the league with the increases that were seen in the early years of the current expansion (which ranged from 4.5 percent), this level of growth was an absolutely vital component to economic growth during the past year. As has been stressed in previous *Economic Reports to the Governor*, consumer spending constitutes nearly two-thirds of all economic activity. Without growth in consumer spending, economic expansion is difficult to sustain. Last year following the stock market crash there were several reasons to anticipate that consumer spending would decline from earlier levels. First, the decline in the value of equities acted to reduce the real wealth position of many Americans. Second, the collapse of financial markets was widely believed to have shaken consumer confidence, and would thus cause consumer spending to drop commensurately. In the year that has followed, however, consumers have defied these predictions by continuing to spend at a healthy rate.

Perhaps even more surprising than the level of growth in consumer spending has been the pattern of growth. Expenditures on durable goods, those that last longer than 3 years, have grown by nearly 5 percent in 1988, while nondurable goods spending has increased by a more modest .6 percent. Since consumers typically retrench first in the area of durable goods purchases, the healthy growth in this area indicates that consumers remain optimistic about their ability to continue to pay for big-ticket items. This confidence can be seen in Figure 3, which illustrates that the Index of Consumer Sentiment, compiled by the University of Michigan's Survey Research Center, has grown by a significant margin since the early months following the stock market

collapse. Beyond the rebound of the Index following the stock market crash, the recent increases in the Index have further baffled economists, since those factors that are thought to heavily influence consumer sentiments (most notably interest rates and inflation) have both increased somewhat in recent months. Regardless, the basic theme to be taken from the pattern of consumer spending is that during 1988 most consumers were confident that the economic expansion would continue, and their spending patterns have reflected this optimism.

Aggregate investment spending has been quite healthy during 1988, with growth of over 10 percent. This aggregate number, however, masks a relatively wide variance in the sectors in which investment is occurring. For example, investment in office and computer equipment has grown by 28 percent in 1988, while investment in multi-unit housing has fallen by approximately 20 percent. More generally, investment has been concentrated in the nonresidential area (up 10.6 percent), while residential investment, including single-family homes, has retracted somewhat (down 3 percent).

The federal government's fiscal situation remains, more or less, the same in 1988 as in recent years. The passage of the Gramm-Rudman-Hollings (GRH) Act and the Balanced Budget Reaffirmation Act of 1987 have put some pressure on Congress and the Administration to resolve their differences regarding spending priorities. The result was that, for the first time in recent memory, the Congress passed and the President signed off on a budget before Congress adjourned. The federal budget deficit for 1988 will be about $150 billion. The budget just passed for fiscal year 1989 is expected to carry a $145 billion deficit, just under the $146 billion target established in the GRH Act. Overall, the solid economic performance of the nongovernmental sectors of the economy have helped moderate the size of the deficit by increasing tax receipts and reducing transfer payments relative to what we anticipated at the same time last year. As stated most succinctly by the Congressional Budget Office (CBO), however, "None of the deficit's improvement stems from policy decisions." (*The Economic and Budget Outlook: An Update*, Congressional Budget Office, August 1988, p. 42.)

As we anticipated last year, the foreign trade deficit has improved moderately since last year. For the first seven months of this year it was $80 billion, compared to $98 billion for the first seven months of 1987. This suggests that the falling value of the dollar since 1985 has finally begun to push up import prices and drive consumers toward the relatively cheaper domestic products. The dollar strengthened somewhat over the summer months relative to other major currencies but has now reversed itself. Together these factors will result in a merchandise trade deficit of approximately $120 billion for 1988, down from about $160 billion in 1987.

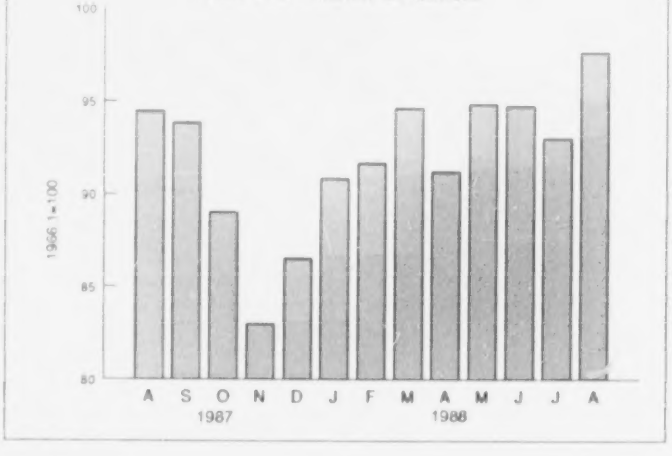
Government Fiscal and Monetary Policy

Aside from consumer expenditures, the spending and tax patterns of the federal and state governments constitute the largest component of final GNP. Accordingly, it should go without saying that governmental policies will certainly affect economic performance in the years to come. Similarly, the vital linkages between monetary policy and aggregate economic performance are incontrovertible. In this section we review the current and prospective mix of fiscal and monetary policies and their impact on national economic performance.

Despite a long season of presidential and congressional politicking, the principal economic issue identified by the American people - the federal budget deficit - went largely undiscussed. The American electorate has failed thus far to demand that our political leaders offer serious solutions to the deficit problem. At the same time, neither George Bush nor Michael Dukakis offered particularly credible solutions. In the case of President Bush, the notion that it is possible to increase defense, education, and anti-drug expenditures, not raise taxes and balance the budget is complete nonsense.

For instance, defense, entitlements and other mandatory spending, and net interest on the national debt constitute $942 billion of the 1988 outlays by the federal government. That leaves $178 billion for all other federal government functions in 1988 (including education and anti-drug expenditures, which have been targeted for increases). A "flexible-freeze" on this $178 billion simply *cannot* lead to a balanced budget. Moreover, given that this $178 billion represents education, space and technology programs, agriculture, basic support to general health care, law enforcement, etc., it is very difficult to imagine the massive cuts in these areas (which were already cut relative to the economy during the Reagan years) that would be required to move to a balanced budget. While noting potential revenues from tax evaders, Michael Dukakis, in his proposal to add tax auditors and to trim defense programs, also failed to fully address the structural deficit that currently exists.

FIGURE 3
Index of Consumer Sentiment



The current projections for the budget deficits and public debt under the Bush Administration are given in Table 1, where several important observations emerge. First, both expenditures and revenues are anticipated to increase during the next few years, absent any change in governmental policy. Moreover, even with a moderately healthy economy, low unemployment, and modest inflation, the budget deficit will remain in the $120 - $150 billion range. If we should have an economic downturn or if interest rates should in-

The heightened scrutiny that is now being given to inflation suggests that the Fed stands ready to tighten the monetary aggregates if inflation (currently running just under 5 percent) continues to creep up. Recent softening of economic growth to an annual rate of 2.2 percent in the third quarter has apparently postponed the perceived need by some Fed members to slow the growth of monetary aggregates.

crease, the projected deficit will swell. For instance, if interest rates are only 1 percent higher than anticipated for the next six years, the federal budget deficit will be $11 billion higher in 1990, and, by 1994, $27 billion higher than shown in the CBO forecast in Table 1. Second, under current federal fiscal policies, the federal government debt (debt held by the public) will grow from $2 trillion to $2.8 trillion. Since this debt is financed by sales of treasury bills, notes, and bonds, the growing principal implies that net interest payments on the debt will grow to over $200 billion annually by 1994, absent a change in federal deficit spending.

Finally, projected deficits are well above the targets established by Gramm-Rudman-Hollings. This underscores one point that the political candidates of 1988 agreed upon - that policymakers of the late 1980s and early 1990s will be faced with difficult choices, one of which may involve raising taxes (despite rhetoric to the contrary). Indeed, many people expect the National Economic Commission to recommend increases in excise tax revenues as a step toward higher taxes.

From the aggregate economic performance following the stock market crash and throughout 1988, it is clear that Federal Reserve Board (Fed) officials very deftly managed the financial markets to maintain solid economic growth this year. Nevertheless, a number of significant challenges lie ahead for monetary authorities. In recent meetings of the Federal Reserve Open Market Committee (FOMC), monetary authorities have given key considerations to (1) inflation; (2) economic growth; (3) monetary aggregates; (4) foreign exchange markets, and (5) domestic financial markets. The list of these concerns is less important than the newfound priority on inflation. Earlier in 1988 the principle focus of the Fed was on maintaining economic growth. The heightened scrutiny that is now being given to inflation suggests that the Fed stands ready to tighten the monetary aggregates if inflation (currently running just under 5 percent) continues to creep up. Recent softening of economic growth to an annual rate of 2.2 percent in the third quarter has apparently postponed the perceived need by some Fed members to slow the growth of monetary aggregates. Concerns still remain, however, that the falling value of the dollar (which is inflationary) may yet necessitate some tightening. Given the balance of slightly higher inflation and slower economic growth in the last half of 1988, most analysts anticipate a period of relatively flat or modestly rising interest rates.

Sectors of the National Economy

Gross National Product is the value of all final goods and services produced in the United States. From a strict accounting perspective, GNP is identically equal to the sum of consumption, investment, government expenditures, and net trade (exports minus imports). Therefore, to understand the behavior of GNP, it is necessary to understand the determinants of activity in these basic sectors. Accordingly, in the paragraphs that follow, we review the performance of these sectors and examine their prospects for 1989 and beyond.

Consumer spending has been a major catalyst for the economic expansion beginning in late 1982. During the 1983-1986 period the growth rate of real personal consumption expenditures was over 4 percent. More recently, annual growth rates have slipped to the 2-3 percent range. This year, and particularly in the last few months, signs have begun to emerge that consumer spending is truly slowing down. The third quarter data reveal that consumer durable spending was flat (compared to rapid growth earlier in the year), though consumer nondurables and services consumption remained moderate. Overall, consumer spending should grow by 2.7 percent in 1988, followed by growth rates in the 2.0 to 2.4 percent range for the next three years. The historical and forecast growth rates for real consumer expenditures are given in Figure 4.

Investment has been very solid during 1988. The growth rate of business

TABLE 1
CBO Baseline Projections of Revenue, Outlays, and Deficits
(By Fiscal Year)

	In Billions of Dollars						
	1988	1989	1990	1991	1992	1993	1994
Revenues	908	980	1,064	1,134	1,202	1,276	1,354
Outlays	1,063	1,127	1,200	1,265	1,329	1,397	1,475
Deficit Held	155	148	136	131	126	121	121
by the Public	2,031	2,178	2,313	2,441	2,566	2,686	2,806
Reference: Balanced Budget Act Deficit Targets (Billions of $)	144	136	100	64	28	0	a

a. The Balanced Budget Act sets deficit targets only through fiscal year 1993.
Source: Congressional Budget Office

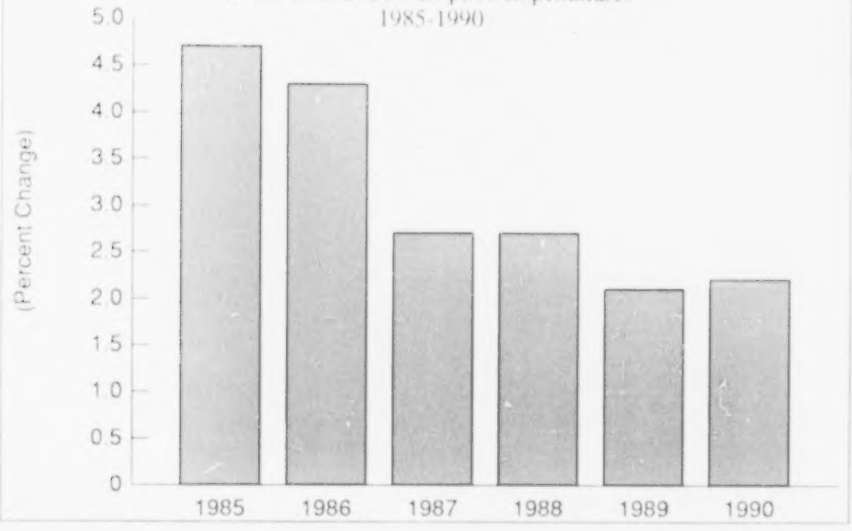
fixed investment should be in the 10 - 11 percent range for the year. Given the slightly upward creeping pattern of interest rates during 1988, the reason for the robust growth is not attributable to a declining cost of capital. Instead, an examination of capacity utilization rates suggests that the reason for this solid performance is the high level at which factories have been operating during 1988. The so-called "accelerator principle" of investment indicates that where overall economic activity is high, firms will be driven to make investments that would otherwise be passed by. The strong cumulative performance of the aggregate economy during the past five years suggests that the accelerator principle is indeed driving the healthy rate of investment growth. The underlying strength of recent economic activity is reflected in Table 2, where the time path of the capacity utilization rate for domestic manufacturing is shown.

As noted in our discussion of fiscal policy, current spending and tax patterns by the federal government will lead to both high spending and higher tax receipts over the next few years. Federal spending is currently in excess of $1 trillion annually and is expected to grow to nearly $1.5 trillion by 1994. If we consider this spending growth in isolation, the increased government spending will clearly act to stimulate the economy over the next few years. The downside of government fiscal policy is that the mounting federal debt will, among other things, lead to a rapidly growing share of the federal budget's being siphoned into "net interest" payments to holders of the public debt instruments. The Congressional Budget Office currently estimates that net interest payments will grow to over $200 billion by 1994 unless projected deficits are reduced. To put these net interest payments into perspective, consider that by 1994 it will take the sum of all corporate income taxes, all federal excise taxes, all estate and gift taxes, and all custom duties revenues just to pay the annual net interest expenses necessitated by the massive federal debt. Unless reduced, this siphon will undermine the ability of the federal government to respond to the most basic of demands for new public services or to engage in counter-cyclical policies.

Finally, consider the role of net foreign trade on the national economy. Since 1985 the foreign trade sector has defied a progression of economic analysts who have predicted that the trade imbalance would rather quickly turn around. This year we have, however, finally begun to see tangible signs that the trade deficit is beginning to shrink. In 1987, real merchandise exports grew by 15 percent, and in 1988 real merchandise exports will grow by 20 percent.

On the other hand, import growth has slowed from earlier double-digit levels to less than 7 percent in 1988. The result is that the merchandise trade deficit will fall from nearly $160 billion in 1987 to approximately $120 billion in 1988. Moreover, it is now believed that under current and projected domestic economic conditions the merchandise trade deficit will continue to fall beyond 1990. It is important to note, however, that while improvements in the trade balance can be expected in the next few years, the total amount of economic activity that is related to foreign trade will undoubtedly grow in the future. The implications for Tennessee of this increasing "internationalization" are examined in the following article.

FIGURE 4
Real Personal Consumption Expenditures
1985-1990



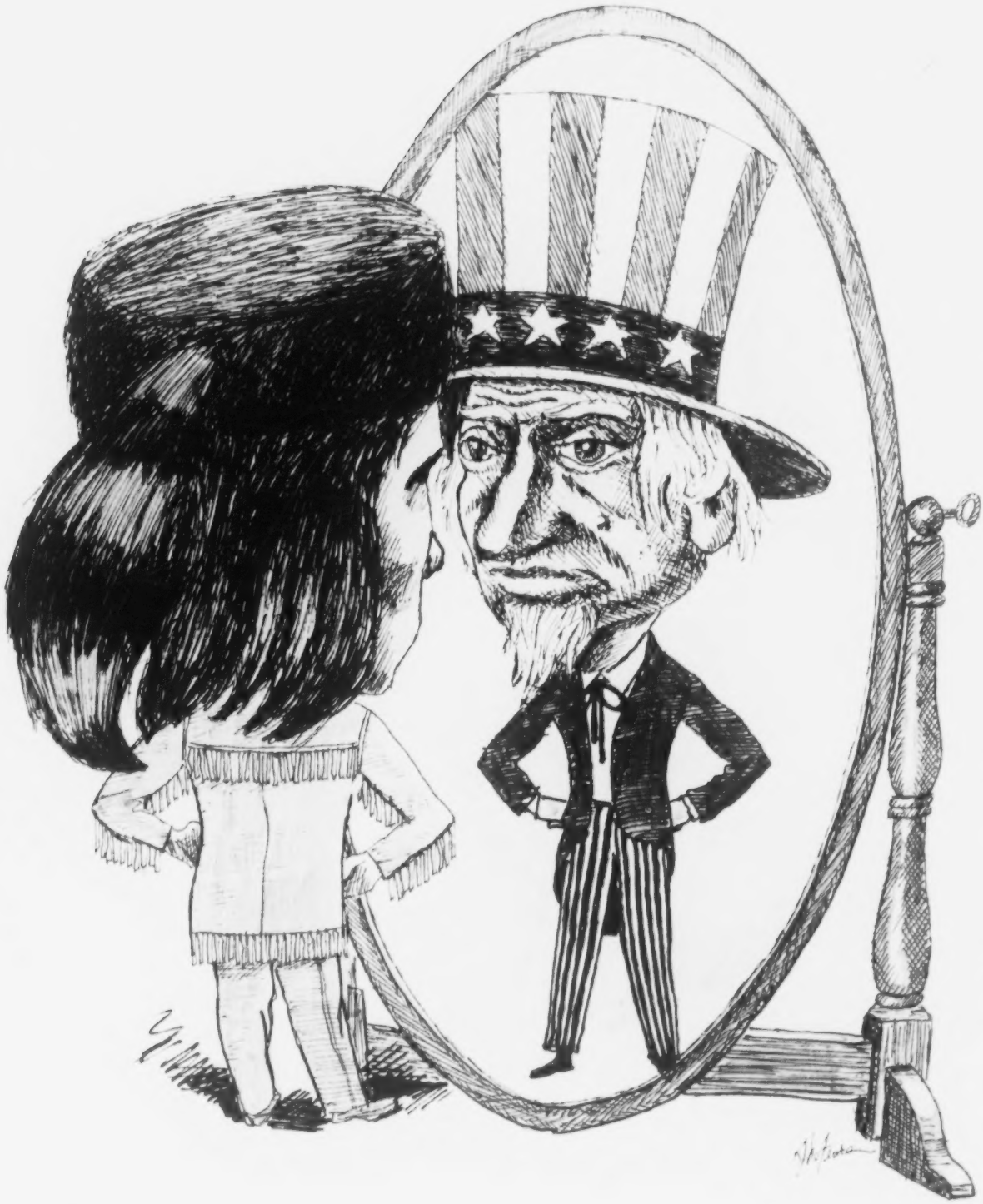
Forecast Overview

In recent months the economy at the national level has shown some signs (e.g., an easing of consumer spending growth) of slowing down from relatively high growth rates (over 4 percent) in the first half of 1988. However, these signs are not believed to signal any significant shift toward recession. In fact, slower growth in some ways is more sustainable and hence more desirable in the long run than the frenzied growth that prompted renewed inflationary fears early in 1988.

Overall, real GNP will grow at 3.8 percent during 1988, and in the neighborhood of 2 to 2.5 percent over the next few years. Consumer spending will continue to be moderate, investment will grow by 2-4 percent, government expenditures will grow by 1-2 percent, and the foreign trade sector will improve over the next couple years. Inflation is anticipated to be near 5 percent, though if the dollar were to fall more rapidly than expected, inflation could be driven higher. Finally, the national unemployment rate is expected to remain under 6 percent for the forecast period. ■

TABLE 2
Capacity Utilization Rates

Year	Capacity Utilization
1982	70.3
1983	73.9
1984	80.6
1985	80.1
1986	79.7
1987	81.0
1988	83.5



OUTLOOK FOR THE TENNESSEE ECONOMY

by David M. Mandy and Matthew N. Murray

Agriculture Sector by Burton English

As is usually the case, the behavior in Tennessee reflects similar events at the national level, and a recession at the national level appears unlikely at this time.

The Short-term Outlook for Tennessee

The ambiguity which characterizes recent economic performance in Tennessee makes it difficult to determine whether the economy will continue expanding or whether a recession is imminent. As is usually the case, the behavior in Tennessee reflects similar events at the national level and a recession at the national level appears unlikely at this time.

Although recent fluctuations have been more pronounced and have thus produced slower growth in Tennessee than in the U.S., the situation is more stable than last year at this time, when uncertainty over the effects of the stock market collapse made the outlook extremely hard to determine. Given the weakness displayed recently by both the Tennessee and U.S. economies, the uncertainty this year takes the form of deciding whether there may be any upcoming events that would be significant enough to push the economy into a recession.

Recent Economic History

Both the Tennessee and U.S. economies rebounded from the events of October 1987 with surprising ease. Real Tennessee personal income grew by 2.7 percent in the first quarter of 1988, following an incredible 7.4 percent growth rate in the last quarter of 1987. Real U.S. gross national product (GNP) also expanded rapidly at the end of 1987, registering 6.1 percent growth, and continued growing into 1988 with 3.4 percent growth in the first quarter. U.S. growth slowed to 3.3 and 2.7 percent during the second and third quarters of 1988, respectively. Hence, it now appears that overall real GNP growth for the U.S. will be 3.9 percent for 1988, a surprise for many analysts who predicted 1988 growth to be only slightly above 2 percent following the stock market collapse.

The short-term forecast calls for slow but positive growth for Tennessee. Growth for all of 1988 will be lower than 1987, and the weak growth in the last half of 1988 will carry over into 1989. Then, in 1990, the Tennessee economy should exhibit renewed growth similar to that experienced in recent years.

However, real income growth in Tennessee has lagged behind U.S. output growth in 1988, and we now expect only 2.6 percent growth for Tennessee in 1988.

This recent sluggishness of the Tennessee economy can be seen by comparing recent growth with experience over the current expansion. Figures 1 through 4 display major indicators of the Tennessee economy over the current and previous expansions. For the statistics which display secular growth trends, the data are indexed so that the beginning of each expansion is 100. This leaves only the unemployment rate in its raw form and facilitates direct comparison of the performance of the Tennessee economy over the current and 1975-1979 expansion.

Figure 1 shows that aggregate real personal income growth over the current expansion has now surpassed aggregate growth over the corresponding time period of the previous expansion. However, the current expansion is completing its sixth year, two years longer than the previous expansion, so that the annual growth rate has been slower than in the expansion years of the late 1970s. Moreover, we still have not attained the aggregate growth achieved in the late 1970s before the 1980 recession began. The figure also illustrates that income growth has slowed recently, but is projected to grow slightly faster in 1989.

Figures 2 through 4 show various measures of labor market activity over these same time periods. Unlike income growth, Figure 2 shows that the Tennessee economy has generated more employment growth over the current expansion than over the previous expansion. Employment levels were higher during the first quarter of 1988 than at any time in Tennessee's history. This resulted from annual growth which exceeded 3 percent every year since 1984, and extremely fast growth in late 1987 and early 1988. However, seasonally adjusted nonagricultural employment actually fell from February through September, and a resumption of the growth rates experienced earlier this year is not anticipated even though employment increased in October. Moreover, a broader measure of employment--employed persons--fell from October 1987 to October 1988. This pattern is also displayed in Figure 3, which shows that the state unemployment rate finally dropped below the levels of the 1970s in early 1988. The first quarter of 1988 was the first quarter this decade in which the unemployment rate averaged less than 6 percent. However, more recent data has indicated a return to 6 percent unemployment rates, confirming the sluggishness reflected in employment. Sluggishness is even more evident in the manufacturing sector, where recent decreases in employment have returned total manufacturing employment to last year's levels. This follows dismal performance throughout most of the current expansion. Figure 4 shows that manufacturing employment during the 1980s has never approached the peaks attained during the late 1970s. This indicates a structural change in the Tennessee economy and a loss of manufacturing employment that will not be recovered in the near future. In 1987, manufacturing employment accelerated, providing some hope for recovery of the manufacturing sector. Growth occurred in both durable and nondurable goods, but both sectors have experienced employment declines recently.

Short-Term Forecast

In response to the modest growth experienced recently in Tennessee, the short-term forecast calls for slow but positive growth for Tennessee overall. Growth for all of 1988 will be lower than 1987, and the weak growth in the last half of 1988 will carry over into 1989. Then, in 1990 the Tennessee economy should exhibit renewed growth similar to that experienced in recent years. This is a most likely scenario, and as such, depends upon no major changes in the exogenous environment in which the Tennessee economy operates. If any of the recession catalysts discussed above should occur at the national level, the outlook for Tennessee could suddenly become much worse. Table 1 provides the forecast overview for 1988 and 1989.

Employment

Total Tennessee nonagricultural employment increased at a very rapid 4.1 percent in 1987. This rate will decrease to about 2.4 percent for all of 1988, and will continue decreasing to 1.1 percent in 1989. Most of this slower growth is due to absolute decreases in employment in the second and third quarters of 1988. At seasonally adjusted annual rates, employment fell by 1.2 percent in both of these quarters. Hence, even renewed growth in 1989 will not produce strong annual growth until 1990.

Virtually every major sector of the Tennessee economy will experience slower employment growth in 1988 and 1989. Figure 5 shows employment growth by sector for 1988 and 1989. Mining employment has been falling steadily in recent years, so the outlook for 1988 and 1989 is simply a continuation of the current trend. Construction employment grew very rapidly at the end of 1987 and early in 1988. Thus, despite declines in the second and third quarters of 1988, construction employment will still register 2.8 percent growth for the year. These decreases will become manifest in 1989, however, when construction employment will decrease by 2.3 percent. Manufacturing employment growth was 1 percent in 1987, the first year of positive growth since the recovery year of 1984. Growth in this sector should decrease to 0.8 percent in 1988 and decline a further 0.4 percent in 1989. During the first three quarters of 1988, seasonally adjusted nondurable manufacturing employment declined 0.5, 4.7, and 1.5 percent at annual rates, accounting for most of the slowdown in total manufacturing. Textiles and apparel were responsible for the renewed growth in nondurable manufacturing in late 1987, and these two sectors, along with food and chemicals, are responsible for the employment losses in 1988. Among the durable manufacturing sectors, lumber and transportation equipment are show-

FIGURE 1
Tennessee Real Personal Income Indexes
(Recession Trough = 100.)

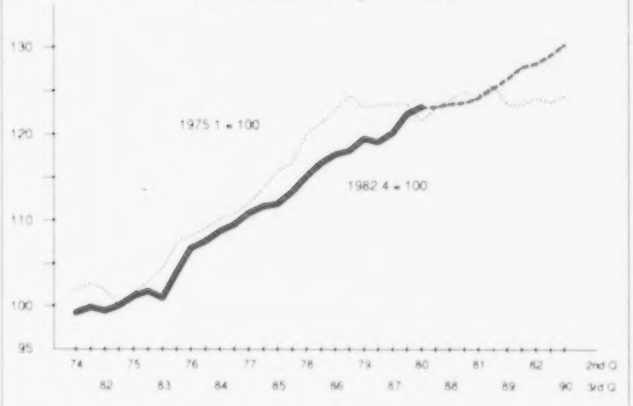


FIGURE 2
Tennessee Total Nonagricultural
Employment Indexes
(Recession Trough = 100.)

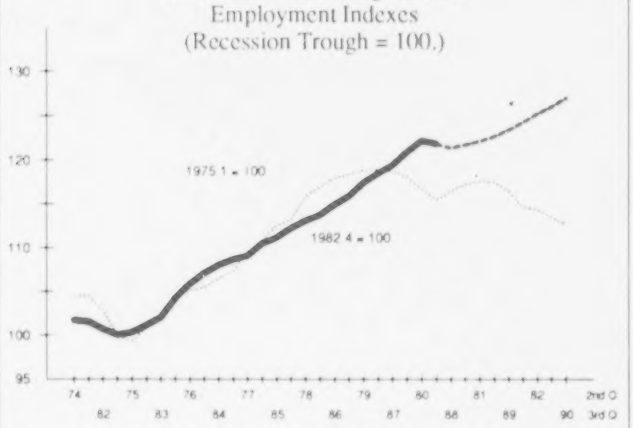


FIGURE 3
Tennessee Unemployment Rate
(Percent)

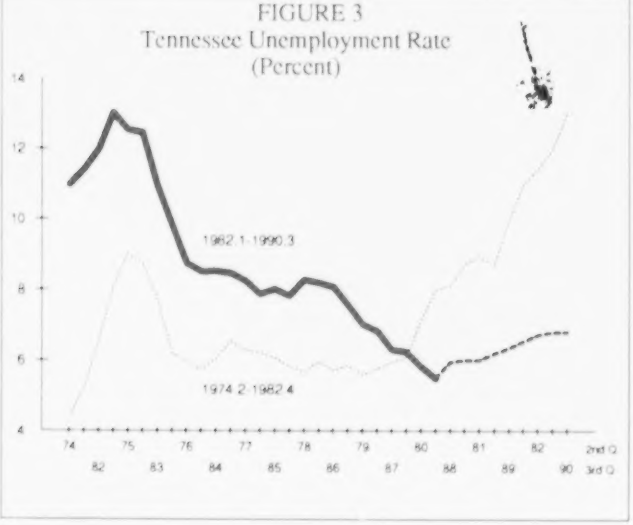
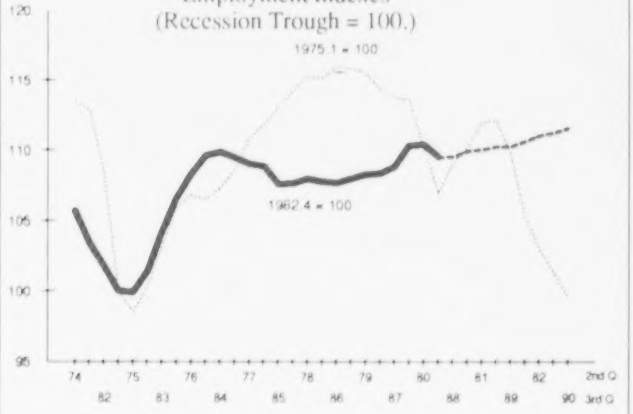


FIGURE 4
Tennessee Manufacturing
Employment Indexes
(Recession Trough = 100.)



ing weakness in 1988, but the remaining sectors are growing quickly enough to keep total durables growing at 1.8 and 0.9 percent in 1988 and 1989, respectively.

Normally vigorous sectors of the Tennessee economy are also showing weakness. Trade employment is experiencing its worst year since 1983, with growth for 1988 expected to average 2.3 percent. This compares with average growth rates of about 5 percent during the 1984-1987 period. The pattern is similar for services, with 1988 growth projected at 3.7 percent, down from 5.8 percent in 1987 and an average 5.9 percent growth rate for the 1984-1987 period. Finance, insurance, and real estate (FIRE) growth has been decreasing since the third quarter of 1987, but will probably show a small increase in the third quarter of 1988. Hence, employment in this industry will be virtually flat in 1988 at 0.6 percent growth, a dramatic decrease from the 6.9 percent growth in 1987 and the average 5.6 percent growth during the 1984-1987 period. Transportation, communications, and public utilities (TCPU) employment is faring better in 1988, and should register 3.9 percent growth for the year. However, much of this growth is due to a large increase in the first quarter in 1988, so the outlook for 1989 is a slowing to 1.9 percent growth. This follows 5.8 percent growth in 1987 and average growth of 5.4 percent over 1984-1987.

Government employment is showing healthy growth during 1988, with the exception of the TVA RIF. Seasonally adjusted state and local government employment grew by 4.9 and 3.8 percent at annual rates in the first and second quarters of 1988, respectively. The total for 1988 should be about 4.3 percent, up from 3.8 percent in 1987 and above the 1984-1987 average of 2.9 percent. However, federal civilian employment

TABLE 1
Selected U.S. and Tennessee Economic Indicators

SEASONALLY ADJUSTED

	HISTORY	FORECAST - DATA										ANNUAL		
	198801	198802	198803	198804	198901	198902	198903	198904	199001	199002	199003	1987	1988	1989
US GNP (BIL 82 $) SAAR	3956.1	3988.1	4014.5	4033.8	4056.5	4066.0	4081.3	4097.8	4102.0	4130.9	4167.4	3847.0	3998.1	4075.4
% CHG PREV QTR SAAR	3.42	3.27	2.67	1.94	2.27	0.94	1.51	1.63	0.41	2.85	3.59	3.37	3.93	1.93
% CHG SAME QTR LAST YR	4.75	4.32	3.86	2.83	2.54	1.95	1.66	1.59	1.12	1.60	2.11	3.37	3.93	1.93
US PERS CON DEFL (1982=100)	122.2	123.7	125.1	126.5	128.2	129.8	131.3	132.7	134.4	136.1	137.7	119.5	124.4	130.5
% CHG PREV QTR SAAR	2.32	5.00	4.47	4.72	5.32	5.09	4.69	4.44	5.31	4.98	4.76	4.48	4.09	4.91
% CHG SAME QTR LAST YR	4.18	4.04	4.04	4.12	4.88	4.90	4.96	4.89	4.88	4.86	4.87	4.48	4.09	4.91
TN PERSONAL INCOME (MIL $) SAAR	64875	65696	66608	67438	68608	70085	71520	73046	74261	75717	77325	57609	61956	66154
% CHG PREV QTR SAAR	5.06	5.16	5.67	5.08	7.13	8.89	8.44	8.81	6.82	8.08	8.77	7.55	6.78	7.05
% CHG SAME QTR LAST YR	7.34	7.63	6.97	5.24	5.75	6.68	7.37	8.32	8.24	8.04	8.12	7.55	6.78	7.05
TN PERSONAL INCOME (MIL82$) SAAR	53089	53109	53260	53306	53533	54011	54488	55049	55245	55649	56174	51851	53191	54270
% CHG PREV QTR SAAR	2.68	0.15	1.15	0.35	1.71	3.62	3.58	4.18	1.43	2.95	3.83	2.93	2.58	2.03
% CHG SAME QTR LAST YR	3.04	3.45	2.81	1.07	0.84	1.70	2.30	3.27	3.20	3.03	3.09	2.93	2.58	2.03
US PERSONAL INCOME (BIL82$) SAAR	3233.6	3251.3	3270.2	3285.3	3304.0	3319.4	3341.8	3361.1	3362.1	3380.8	3405.6	3163.5	3260.1	3331.6
% CHG PREV QTR SAAR	2.27	2.22	2.34	1.85	2.30	1.88	2.73	2.33	0.13	2.24	2.97	2.45	3.05	2.19
% CHG SAME QTR LAST YR	3.18	3.47	3.42	2.17	2.18	2.09	2.19	2.31	1.76	1.85	1.91	2.45	3.05	2.19
TN NONAGRIC JOBS (THOUS)	2062.2	2056.2	2050.0	2054.9	2061.7	2071.5	2082.9	2098.5	2114.7	2127.9	2144.1	2008.4	2055.8	2078.7
% CHG PREV QTR SAAR	4.37	-1.17	-1.19	0.97	1.32	1.91	2.23	3.03	3.12	2.51	3.08	4.08	2.36	1.11
% CHG SAME QTR LAST YR	4.14	2.89	1.75	0.72	-0.02	0.75	1.61	2.12	2.57	2.72	2.94	4.08	2.36	1.11
US NONAGRIC JOBS (MIL)	104.7	105.6	106.5	106.9	107.1	107.2	107.4	107.5	107.6	107.8	108.1	102.3	105.9	107.3
% CHG PREV QTR SAAR	3.86	3.59	3.36	1.46	0.97	0.43	0.47	0.43	0.45	0.59	1.31	2.79	3.51	1.32
% CHG SAME QTR LAST YR	3.61	3.69	3.70	3.06	2.34	1.55	0.83	0.57	0.44	0.48	0.69	2.79	3.51	1.32
TN UNEMPLOYMENT RATE (%)	5.8	5.5	5.9	6.0	6.0	6.2	6.3	6.5	6.7	6.8	6.8	8.0	6.6	5.8
US UNEMPLOYMENT RATE (%)	5.7	5.4	5.3	5.3	5.4	5.6	5.7	5.9	6.1	6.3	6.3	6.2	5.4	5.6
BANK PRIME INTEREST RATE (%)	8.6	8.8	9.8	10.6	11.0	11.5	11.4	11.0	10.5	10.0	9.8	8.3	8.2	9.4
TN MFG JOBS (THOUS)	502.1	498.1	498.4	499.9	500.5	501.5	501.5	503.3	505.1	506.0	507.5	495.4	499.6	501.7
% CHG PREV QTR SAAR	0.29	-3.11	0.22	1.25	0.47	0.80	0.01	1.38	1.49	0.69	1.22	1.00	0.85	0.42
% CHG SAME QTR LAST YR	1.95	1.10	0.70	-0.35	-0.31	0.69	0.63	0.66	0.92	0.89	1.20	1.00	0.85	0.42
TN MFG AVE WEEKLY HOURS	42.1	41.7	41.3	41.4	41.4	41.4	41.4	41.4	41.4	41.3	41.4	41.6	41.6	41.4
% CHG PREV QTR SAAR	1.78	-3.98	-3.55	0.57	-0.41	0.77	-0.14	-0.59	-0.01	-0.86	1.39	0.93	0.18	-0.61
% CHG SAME QTR LAST YR	0.72	1.41	-0.04	-1.33	-1.86	-0.67	0.20	-0.10	0.00	-0.40	-0.02	0.93	0.18	-0.61

SOURCE: QUARTERLY TENNESSEE ECONOMETRIC MODEL,
CENTER FOR BUSINESS AND ECONOMIC RESEARCH, UT-KNOXVILLE.

will decrease by about 1,000 jobs during 1988 due to employment losses at TVA. Because these losses are occurring during 1988, the full impact will not show up in the data until 1989, when federal civilian employment is projected to fall by 3,000 jobs, or 5 percent.

In recent years, the Memphis and Nashville metropolitan areas have produced a large portion of the employment growth statewide. Figure 6 illustrates that employment decreases in these areas have corresponded to the statewide employment decreases during 1988.

As expected, sluggish employment growth has had an adverse effect on the Tennessee unemployment rate in 1988. After falling to about the same level as the U.S. unemployment rate during the second quarter of this year, the Tennessee unemployment rate has increased to 5.9 percent in the third quarter, 0.6 percentage points above the U.S. rate. The earlier decreases in the Tennessee unemployment rate were caused by large decreases in the number of unemployed persons, so that the rate dropped despite the fact that the number of employed persons was decreasing. This situation changed in the third quarter, with the number of unemployed persons increasing and the number of employed persons decreasing. There is no indication that the Tennessee unemployment rate will drop below 6 percent for any extended period over the next two years.

Inflation

Inflation, as measured by the U.S. personal consumption deflator, continues to be moderate. Price increases averaged 4.5 percent during 1987 and will average only slightly over 4 percent for 1988 before accelerating to the 5 percent range in 1989. These price increases follow inflation rates of 2.5 to 3.5 percent in recent years, so the Tennessee economy has experienced and will experience higher inflation than was present earlier in the current expansion. However, these inflation rates are much lower than most years during the 1970s, and are acceptable given recent declines in the value of the dollar. If the dollar's decline causes import prices to increase sharply, and domestic producers take advantage of this situation by increasing prices, then the inflation rate could increase rapidly. While this is a possibility, such a situation would likely bring about tight monetary policy and is thus more likely to initiate a

recession than it is to cause a return to the inflation rates of the 1970 s.

Personal Income

With employment growth declining, a slowing of income growth is almost inevitable. Nominal Tennessee personal income increased by 7.5 percent during 1987, but will only increase by 6.8 percent during 1988. This weakness is due to slower wage and salary and other labor income growth, as the decreases in employment growth takes their toll. The slightly lower inflation of 1988 is also holding nominal income growth down. Real personal income growth will decrease by only 0.3 percentage points in 1988, while nominal growth will decrease by 0.8 percentage points, reflecting the 0.5 percentage point decrease in the inflation rate for 1988. Higher inflation will accelerate nominal personal income growth to over 7 percent in 1989, despite slower real growth of 2 percent. Other factors contributing to sluggish income growth in 1988 are slower growth in proprietors' income and a large increase in personal contributions for social insurance, caused by the increase in the social security tax that took effect at the beginning of 1988. However, most components of personal income will contribute to the faster growth in nominal income during 1989.

Gross State Product

Since income is a large part of gross state product (GSP), Tennessee GSP growth will follow a pattern similar to the income growth pattern discussed above. Nominal growth in GSP was 9.3 percent in 1987, but will decrease in 1988 and 1989 to 5.2 and 6.6 percent, respectively. The deceleration in real GSP growth is not as severe since inflation rates are rising slowly, so real GSP will grow by 2.3 and 2.2 percent in 1988 and 1989, respectively, following 5.5 percent growth in 1987. Figure 7 shows GSP growth by sector for 1988 and 1989.

Sectoral growth in real output differs significantly from sectoral employment growth, especially with regard to manufacturing. Durable manufacturing is forecast as the fastest growing sector for 1988, at 6.9 percent. This contrasts with relatively slow employment growth in the durable manufacturing sectors, and implies that durable manufacturing will display above-average productivity growth. Historically, employment growth in Ten-

FIGURE 5
Tennessee Nonagricultural Employment Growth
1988 and 1989

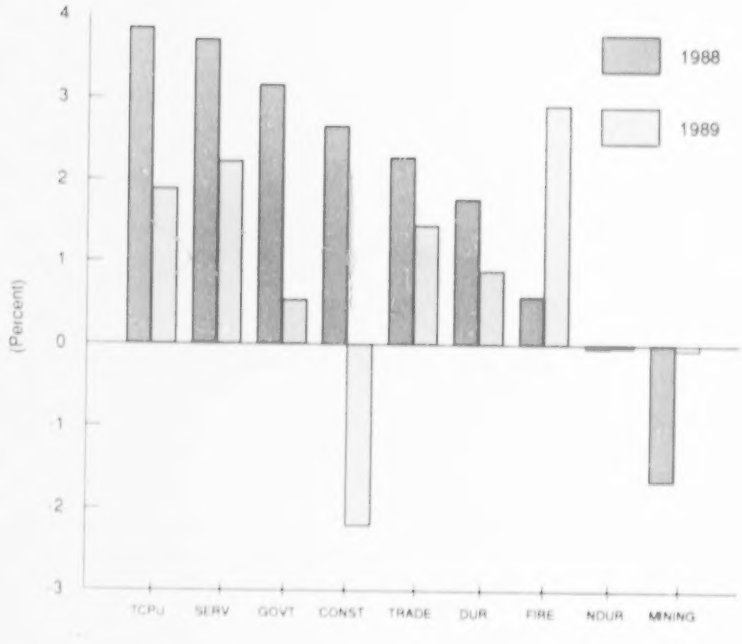
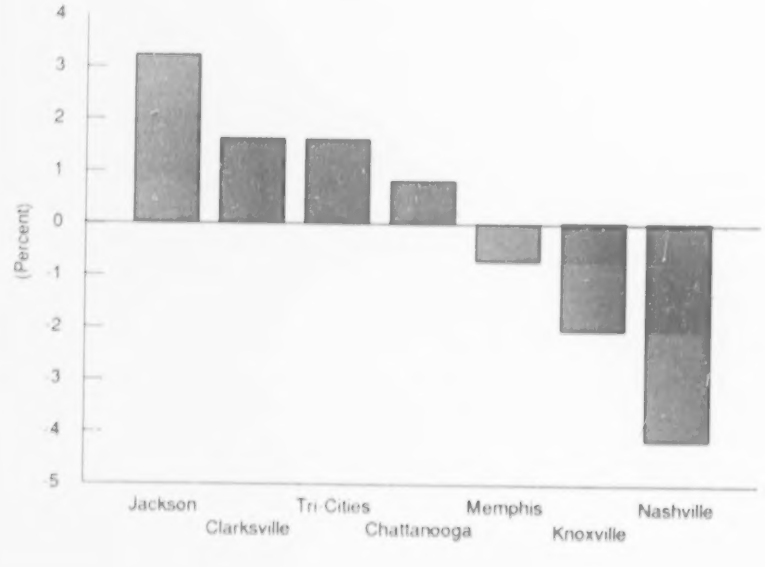


FIGURE 6
MSA Employment Growth
September 1987 - September 1988



A drought hit the nation's midsection this past year, extending from Montana to Ohio and from Indiana through Tennessee. The drought decreased corn, soybean, and wheat production nationwide and had a dramatic effect on commodity stocks. This decline in production resulted in increasing prices, affecting the long-term profitability of the livestock industry.

nessee manufacturing has been slower than output growth, so that relatively strong productivity growth in manufacturing is normal. Other sectors with above-average real output growth in 1988 will be FIRE and TCPU, at 4.7 and 3.9 percent. However, these growth rates are both lower than the corresponding 1987 growth rates of 6.3 and 8.7 percent, and the deceleration in these industries will continue into 1989 with 3.0 percent growth in FIRE and 1.6 percent growth in TCPU. The other major sectors of the Tennessee economy will also display slower growth in 1988 and 1989 than in previous recent years.

Sales

Nominal taxable sales growth has been on a downward trend in Tennessee for several years, from 16 percent in 1984 to 6 percent in 1987. This is largely due to a sales tax base that is not growing as fast as the overall economy. As a larger proportion of consumption moves to the service sector, the proportion of consumption that is subject to the sales tax declines. For 1988 and 1989 taxable sales growth will slow even more, as slower growth in the overall economy combines with the shrinking (in relative terms) tax base. It now appears that taxable sales growth will decline to about 5.3 percent for all of 1988, and the decline is forecast to continue, with 1989 growth forecast at 4.5 percent. Hence, real taxable sales will be almost flat for 1989.

Agricultural Outlook

A drought hit the nation's midsection this past year, extending from Montana to Ohio and from Indiana through Tennessee. The drought decreased corn, soybean, and wheat production nationwide and had a dramatic effect on commodity stocks. Production of corn decreased to PIK (payment-in-kind) year (1983) levels and wheat production decreased 16 percent. This decline in production resulted in increasing prices, affecting the long-term profitability of the livestock industry. Several government commodity crop programs have been modified or adjusted partially as a result of the drought. Set-aside requirements for wheat and feed grains were reduced to 10 percent of base acreage. In addition, farmers were allowed to plant soybeans on 10 to 15 percent of feedgrain base acres without endangering that base. There have been no paid diversions announced for the coming year. As stocks of feedgrains, soybeans and wheat have been significantly reduced, price projections for these crops will be particularly sensitive to weather patterns in 1989.

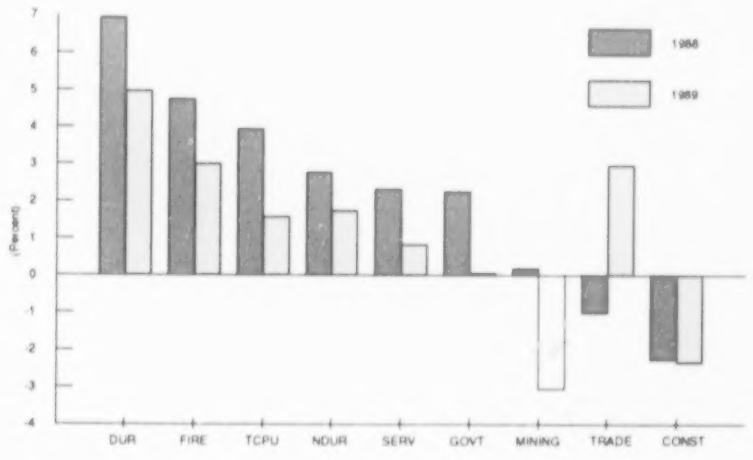
On the other hand, cotton stocks have significantly increased, reducing the probable level of price volatility for cotton. Therefore, cotton set-aside requirements were increased from 12.5 percent of base acreage last year to 25 percent this year.

Crop Commodities

Feedgrains: Tennessee farmers should expect reasonable returns to corn and other feedgrains for the 1989 crop year (see Figure 8). Given normal weather, corn prices should remain strong throughout the winter at approximately $2.75 per bushel. A price decrease is likely from the spring through harvest with $2.15 per bushel a likely price at harvest. However, if the weather pattern is not conducive to high production in the corn belt, significant price increases could occur. Government commodity program targets and loan rates have been announced for corn, sorghum, barley, and oats. Target prices are $2.84, $2.70, $2.43, and $1.80 per bushel respectively, with loan rates of $1.65, $1.57, $1.34, and $0.85 per bushel respectively.

Cotton: The outlook for cotton producers is not as promising as in the previous year. Yields in 1988 were less than the record levels of the year before, but still slightly higher than average (see Figure 9). However, cotton prices will suffer from both excess production and slack demand. Domestic consumption of cotton is likely to decline again this year, with mill use off 8 to 10 percent. Exports of cotton may decline by as much as 25

FIGURE 7
Tennessee Real Gross State Product Growth
1988 and 1989



percent, as foreign stocks have risen. Producers should expect prices around the loan rate, assuming slightly higher-than-average yields and only modest declines in acreage as acreage only slowly shifts out of cotton into other crops. Upward price movement will be limited by large surplus stocks. Current estimates peg the surplus at or approaching annual production.

Soybeans: Demand will continue to be slack as exports continue to decline. Soybean acreage should increase slightly in 1989, due to recent price increases (see Figure 10). However, this acreage will not be at the expense of corn acreage, as soybean prices would have to increase to $7 per bushel to compete with the expected corn target price of $2.84. Thus, as domestic acreage increases are experienced, soybean prices should decline, given the somewhat stagnant demand. With normal weather conditions in the Cornbelt, soybean prices will be below $6.60 per bushel by harvest.

Wheat: Wheat was the most promising crop in Tennessee this past year. Spring dryness contributed to a decrease in disease problems, a factor contributing to a state average of 50 bushels per acre. Total supplies nationwide are much smaller than a year ago since, as expected, crop size decreased 16 percent. A resulting increase in seeding this coming year is expected. Average wheat prices in Tennessee may be $3.40 per bushel for the marketing year, and the total Tennessee crop may increase up to 40 percent above recent production levels.

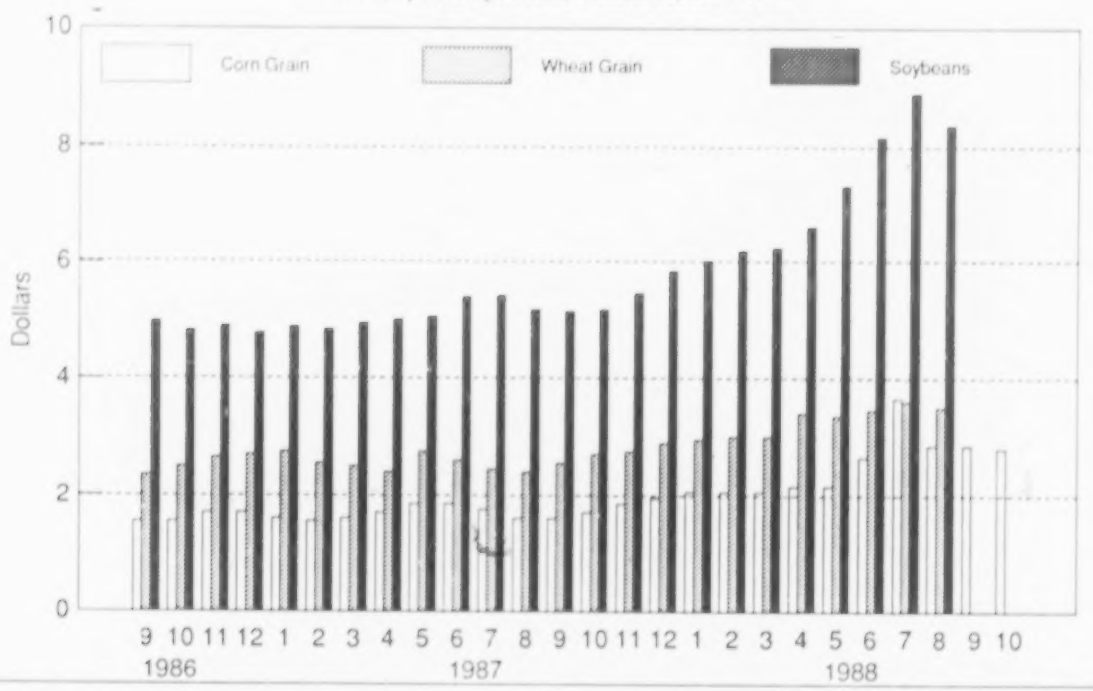
Tobacco: Dry weather kept burley tobacco production below average in 1988, but yields were not as low as in 1987. The outlook for the 1989 crop is somewhat better for the coming year than in recent years. Tobacco use outstripped production by 100 million pounds in 1988. Stocks of tobacco have been reduced to the point where quota increases for 1989 are almost certain, and prices for high quality tobacco are likely to remain strong.

Livestock Commodities

Swine: Hog numbers in the U.S. have increased and the higher supply will likely result in decreased hog prices for 1989. Feed costs have also increased with the hog to corn price ratio falling from 35:1 to 14:1 within the past year. The resulting decrease in profitability may curtail industry expansion. If hog numbers stabilize, prices will range from $40 to $50 per hundreweight (cwt.) for much of the year, perhaps approaching $50 per cwt. by the end of the year. If expansion continues, however, prices will remain depressed, below $40 per cwt. for much of the year. Return to land, labor, and capital for a 96 sow unit is projected to decrease by $250 per sow, largely a result of increased feed cost. Smaller producers should be able to compete with the 10,000 sow units being considered in some parts of the country. However, returns may be reduced for typical Tennessee producers when compared to other regions of the country.

Beef Cattle: Although cattle numbers continue to decline, the bottom of the cattle cycle should occur during 1989. Thus, prices should remain high during the initial part of the year with 400-500 pound feeders going for about $100 per hundredweight, and yearlings going for $80 to $85 per hundredweight. These prices are likely to decline by approximately 5 percent near the end of the year. A fear in the industry is that beef is pricing itself out of consumers' diets and that changes in the preferences of consumers could occur, resulting in a decline in demand. Significant losses could occur in the event of such declining demand, in conjunction with increasing beef supplies as the cattle cycle turns. The coming year, however, will probably be as profitable for beef producers as any

FIGURE 8
Corn Grain, Wheat, and Soybean
Monthly Average Price, Tennessee, 1986-1988



year in the past ten, as the rate of cattle price increases have outpaced the rate of feed cost increases.

Dairy: The outlook for the dairy industry is not as bright as in previous years. Milk prices will average $13 per hundredweight with some milk valued at up to $13.50 per hundredweight. However, these prices will not offset the increases in feed prices as feed costs are projected to increase 35 percent. Dairy farmers will be likely to experience decreases in net income of approximately 20 to 30 percent.

Tennessee's Long-run Outlook

Since the recession of 1982, the state economy has exhibited a robust performance. In the face of numerous risks and a variety of mild shocks, the recession forecast by most economists for more recent years has not been forthcoming. In fact, the long-run outlook projects continued economic growth and prosperity, a trend that is premised on historical patterns of economic growth. Although certain risks are inherent in the forecast period, including those related to the budget and trade deficits, the long-run forecast embodies no recession.

Selected Economic Indicators

In Table 2, selected economic indicators are presented for the U.S. and Tennessee for the 1988 to 1997 long-run forecast period. Growth in inflation-adjusted output for the state, as measured by gross state product (GSP), will exceed 2 percent for each year of the forecast. In only two years--1989 and 1990--will growth in gross national product (GNP) fall short of 2 percent.

It is important to note that the GSP data series now used in the Tennessee Econometric Model is a new series provided by the Bureau of Economic Analysis (BEA). The GSP data from BEA are defined consistently across states and provide detail on specific sectors. In addition, it is now possible to separate total agricultural sector output into agricultural services and farm output. Previously, the Tennessee Econometric Model utilized an independent data series on GSP, for both historical and for forecasting purposes, since no other series was available. Because of the differences between the new and the

FIGURE 9
Cotton Lint
Yield Per Acre, Tennessee, 1970-1988

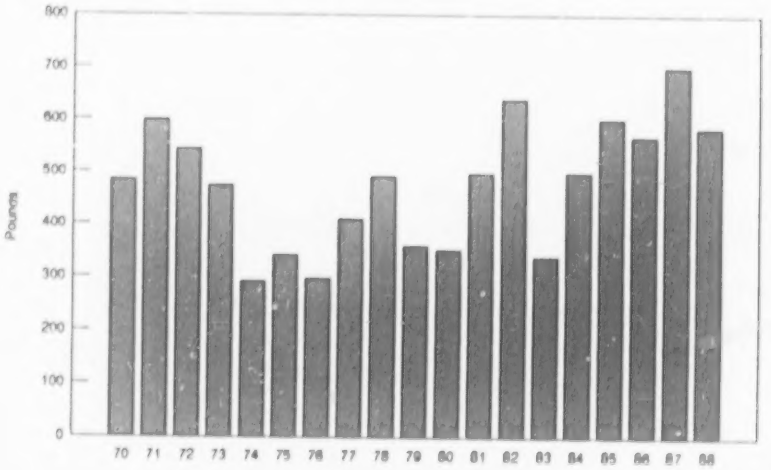
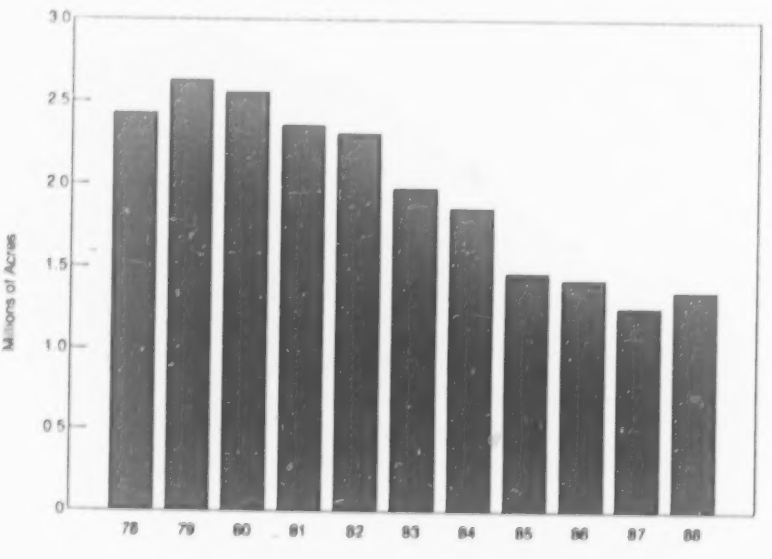


FIGURE 10
Soybean Acres Harvested, Tennessee, 1978-1988



The compound annual growth rate in inflation-adjusted durable goods manufacturing output for the state will be 4.2 percent, slightly above U.S. durable goods output growth of 3.5 percent. Within the durable goods sector , the strongest growth will take place in transportation equipment and nonelectrical machinery, where the compound annual growth rates in output are forecast at 6.2 percent and 5.9 percent, respectively.

old series, comparisons are not appropriate.

Accompanying the moderately strong growth in output will be the growth in personal income and per capita income. For all forecast years, the growth in inflation-adjusted personal income will exceed 2 percent for the state economy; for the U.S., personal income growth rates will slip below 2 percent only in 1990 and 1991.

The pattern of unemployment rate changes and price level increases over the long-run forecast period, where the latter are measured by the implicit deflators, indicates stable economic growth. There is some tendency for unemployment to rise for the state, in part reflecting continued structural change. Inflation is projected to be moderate through 1997.

Finally, productivity in the manufacturing sector (manufacturing sector output per worker) will grow at a very healthy rate for all forecast years. The performance of the U.S. manufacturing sector will exceed that of the state, realizing a 3.4 percent compound annual growth rate in productivity for the U.S. versus 2.7 percent for Tennessee.

Output

In Table 3, compound annual growth rates of inflation-adjusted output are presented for major sectors of the U.S. economy and the Tennessee economy. For historical reference periods, the growth rates are calculated between peaks of major business cycles so as to measure long-run trends as opposed to short-run, or cyclical trends.

Overall state output growth (GSP) is forecast to be 3.2 percent between 1988 and 1997, surpassing anticipated growth in GNP over the same period (2.5 percent on a compound annual basis) and comparing quite favorably with most historical reference periods. With the exception of mining, all sectors of the U.S. and Tennessee economies will realize positive rates of output growth.

Total inflation-adjusted output in the

TABLE 2
Tennessee Selected Indicators

	FORECAST-DATA									
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN GROSS STATE PRODUCT (MIL. DOL.)	83150	88616	96278	103438	111013	119207	127577	137175	147436	158572
PERCENTAGE CHANGE	5.15	6.57	8.65	7.50	7.26	7.38	7.02	7.52	7.48	7.55
TN GROSS STATE PRODUCT (MIL 82 $)	69215.7	70732.7	73715.5	76036.4	78405.6	81156.6	83602.4	86458.8	89385.3	91984.2
PERCENTAGE CHANGE	2.33	2.19	4.22	3.15	3.12	3.51	3.01	3.42	3.38	2.91
US GROSS NATIONAL PRODUCT (BIL 82 $)	3998.3	4075.3	4152.2	4280.6	4397.8	4503.2	4626.3	4750.9	4867.6	4990.2
PERCENTAGE CHANGE	3.93	1.93	1.89	3.09	2.74	2.40	2.73	2.69	2.45	2.52
TN PERSONAL INCOME (MIL. DOL.)	68150	70811	76572	82714	89420	97296	105233	114531	124823	135757
PERCENTAGE CHANGE	6.77	7.05	8.14	8.02	8.11	8.81	8.16	8.84	8.99	8.76
TN PERSONAL INCOME (MIL 82 $)	53183.5	54270.0	55949.5	57422.7	59438.2	62037.8	64292.4	66955.1	69772.8	72500.3
PERCENTAGE CHANGE	2.56	2.04	3.09	2.63	3.51	4.37	3.63	4.14	4.21	3.91
US PERSONAL INCOME (BIL 82 $)	3259.8	3331.5	3394.2	3458.6	3569.3	3650.7	3745.1	3834.0	3913.9	3997.3
PERCENTAGE CHANGE	3.04	2.20	1.88	1.90	3.20	2.28	2.58	2.37	2.08	2.13
TN EMPLOYED PERSONS (THOUS)	2217.4	2219.4	2236.0	2274.1	2317.5	2368.6	2414.0	2457.8	2501.8	2556.8
PERCENTAGE CHANGE	1.67	0.09	0.75	1.71	1.91	2.20	1.92	1.81	1.79	2.20
US EMPLOYED PERSONS (MIL)	115.0	116.4	117.4	119.4	121.1	122.7	124.6	126.5	128.2	130.0
PERCENTAGE CHANGE	2.31	1.22	0.81	1.69	1.48	1.28	1.57	1.56	1.33	1.38
TN UNEMPLOYMENT RATE	5.8	6.2	6.8	6.6	6.7	6.9	6.7	6.6	6.5	6.6
US UNEMPLOYMENT RATE	5.4	5.6	6.2	5.8	5.6	5.6	5.4	5.2	5.1	5.0
IMPLICIT DEFLATOR.GSP	120.1	125.3	130.6	136.1	141.6	146.9	152.6	158.7	164.9	172.4
PERCENTAGE CHANGE	2.78	4.29	4.25	4.22	4.02	3.74	3.89	3.97	3.96	4.51
IMPLICIT DEFLATOR.GNP	121.4	127.0	132.7	138.9	144.8	150.7	157.0	163.7	170.8	178.3
PERCENTAGE CHANGE	3.18	4.54	4.52	4.68	4.28	4.06	4.17	4.28	4.29	4.38
TN MFG OUTPUT/EMPLOYEE (THOUS 82 $)	39.9	41.2	42.8	44.0	45.1	46.6	47.7	48.9	50.1	50.9
PERCENTAGE CHANGE	4.27	3.19	3.79	2.91	2.39	3.35	2.34	2.62	2.39	1.55
US MFG OUTPUT/EMPLOYEE (THOUS 82 $)	45.7	47.0	48.7	50.8	52.6	54.3	56.1	57.9	59.8	61.8
PERCENTAGE CHANGE	4.13	2.82	3.66	4.27	3.40	3.38	3.27	3.24	3.31	3.30
TN PER CAPITA INCOME ($)	13469	14253	15236	16266	17363	18615	19875	21369	23009	24650
PERCENTAGE CHANGE	5.55	5.82	6.90	6.76	6.74	7.21	6.77	7.51	7.68	7.13
TN POPULATION (THOUS.)	4911	4968	5028	5085	5150	5227	5295	5360	5425	5507
PERCENTAGE CHANGE	1.16	1.16	1.16	1.18	1.28	1.49	1.30	1.23	1.22	1.52

SOURCE: ANNUAL TENNESSEE ECONOMETRIC MODEL,
CENTER FOR BUSINESS AND ECONOMIC RESEARCH, UT-KNOXVILLE.

TABLE 3
Compound Annual Growth Rates
in Real Output for Key Sectors
of the Tennessee and U.S. Economies

	Business Cycle Peak to Peak			
	1969-1973	1973-1979	1979-1988	1988-1997
Overall Growth				
Gross State Product	5.5	3.3	3.1	3.2
Gross National Product	3.2	2.6	2.5	2.5
Sector Growth				
Manufacturing				
Tennessee	7.7	2.4	4.0	3.8
U.S.	3.7	1.9	2.8	3.1
Durables				
Tennessee	8.2	2.5	6.5	4.2
U.S.	3.1	2.0	3.3	3.5
Nondurables				
Tennessee	7.2	2.3	1.2	3.2
U.S.	4.8	1.9	2.1	2.4
Construction				
Tennessee	0.7	-0.5	0.2	0.6
U.S.	-1.9	0.3	0.1	1.3
Mining				
Tennessee	4.6	4.9	-1.3	-2.6
U.S.	0.8	-0.4	-1.0	-0.8
Trade				
Tennessee	6.9	3.0	3.1	3.1
U.S.	4.8	2.7	3.1	2.3
Services				
Tennessee	5.5	4.2	4.5	4.0
U.S.	4.3	4.0	4.4	2.5
FIRE*				
Tennessee	7.3	3.3	4.2	3.8
U.S.	4.0	3.8	2.8	2.8
TCPU**				
Tennessee	6.5	4.8	3.1	3.1
U.S.	5.0	3.2	2.4	2.2
Government				
Tennessee	1.1	5.6	-0.0	1.2
U.S.	0.2	1.5	1.3	2.8
Agriculture				
Tennessee	0.4	2.9	0.4	1.1
U.S.	n.a.	n.a.	n.a.	n.a.

*Finance, insurance, and real estate
**Transportation, communications, and public utilities
n.a. not available

manufacturing sector is forecast to grow at a 3.8 percent compound annual rate for Tennessee and a 3.1 percent compound annual rate for the national economy. Both of these growth rates closely parallel the experience of the past decade. Output growth for both Tennessee and the U.S. will likely benefit from an improved international position over the next several years. However, capacity constraints within domestic manufacturing enterprises may act as an impediment to growth.

The compound annual growth rate in inflation-adjusted durable goods manufacturing output for the state will be 4.2 percent, slightly above U.S. durable goods output growth of 3.5 percent. Within the durable goods sector (not shown), the strongest growth will take place in transportation equipment and nonelectrical machinery, where the compound annual growth rates in output are forecast at 6.2 percent and 5.9 percent, respectively. Even the weakest durable goods sectors will experience positive rates of growth: lumber and wood (1.6 percent), stone, clay and glass (1.7 percent) and primary metals (1.5 percent).

Output in Tennessee's nondurable goods manufacturing sector is forecast to grow at a 3.2 percent compound annual rate, comparing favorably with the state's performance between 1979 and 1988, when output grew at only a 1.2 percent rate. The projected improvements vis-a-vis recent history are expected to result, in part, because of dollar depreciation which will expand international marketing opportunities for U.S. producers and exert downward pressure on import competition.

Although some nondurable goods sectors may experience negative rates of output growth for individual years of the forecast period, cumulative growth over 1988 to 1997 will be positive for all sectors. The best performance will take place in printing and publishing, paper, and rubber and plastics, where output will grow at 5.7 percent, 4.9 percent and 4.9 percent, respectively. The most anemic growth appears in textiles, leather and chemicals. For the latter two sectors growth has been hampered by import competition and the high level of the dollar in foreign currency markets through 1985.

In the nonmanufacturing sectors, where state performance is expected to exceed national performance, output growth will be led by services (4.0 percent), followed by finance, insurance and real estate (3.8 percent), transportation, communication and public utilities (3.1 percent) and trade (3.1 percent). Although growth may lag behind historical trends it remains respectable. The most lackluster performances will be realized in mining (-2.6 percent) and construction

(0.6 percent). These two sectors have historically experienced erratic and frequently negative rates of output growth.

Differential rates of output growth across sectors, indicative of dynamic processes at work in the economy, reflect significant underlying structural change. To convey the relative importance of various sectors in terms of their contribution to total state output, Figure 11 illustrates the percent distribution of Tennessee output, by sector, for 1969, 1988, and 1997.

Many have talked about the deindustrialization of the U.S. economy. However, on the basis of Figure 11 this demise of the manufacturing sector appears illusory for Tennessee. In 1969, manufacturing sector output in the state comprised 26.6 percent of nonagricultural gross state product, increased to 29.4 percent in 1988, and is forecast to account for 30.8 percent of nonagricultural output by 1997. For the U.S. (not shown), the manufacturing sector's contribution to total nonagricultural output similarly increased from 22.8 percent in 1969 to 23.1 percent in 1988 and will rise to 24.4 percent by 1997. As shown below, the manufacturing sector has declined in relative importance in terms of employment, although absolute levels of employment have increased in the manufacturing sector.

One important aspect of structural change in manufacturing has been the increased relative importance of durable goods activity. In 1969, 46.3 percent of manufacturing sector output in Tennessee was in durable goods (versus 62.2 percent for the U.S.). By 1997, the state will approach the U.S. in terms of the durable goods sector's contribution to manufacturing output, when 60.1 percent of manufacturing sector output will be attributable to durable goods (as opposed to 65.4 percent for the national economy).

Figure 11 further illustrates a significant decline in the relative importance of the construction, mining, and government sectors. In addition to manufacturing, the services, trade, finance, insurance and real estate (FIRE), and transportation, communication and public utilities (TCPU) sectors have experienced increases in their rates of contribution to the state's nonagricultural output.

FIGURE 11
Percent Distribution of Tennessee Nonagricultural Gross State Product

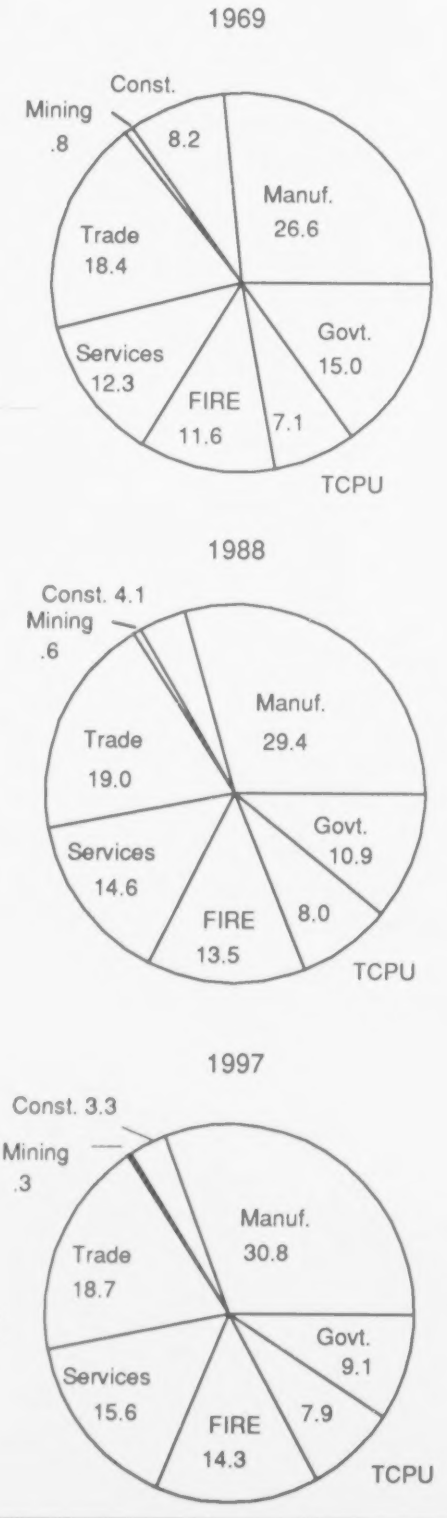


TABLE 4
Compound Annual Growth Rates
in Jobs for Key Sectors
of the Tennessee and U.S. Economies

	Business Cycle Peak to Peak				
	1960-1969	1969-1973	1973-1979	1979-1988	1988-1997
Nonagricultural Jobs					
Tennessee	3.9	4.0	2.5	1.6	2.4
U.S.	2.9	2.2	2.6	1.8	1.4
Sector Growth					
Manufacturing					
Tennessee	4.5	2.6	0.2	-0.5	1.0
U.S.	2.1	0.0	0.6	-0.8	-0.3
Durables					
Tennessee	6.1	4.2	0.7	0.3	1.8
U.S.	2.5	0.4	0.8	-1.1	-0.3
Nondurables					
Tennessee	3.5	1.4	-0.2	-1.3	0.2
U.S.	1.4	-0.3	0.0	-0.3	-0.1
Construction					
Tennessee	4.0	5.7	0.6	1.2	0.2
U.S.	2.4	3.3	1.6	1.8	2.3
Mining					
Tennessee	-0.8	0.0	7.0	-5.0	-1.6
U.S.	-1.7	0.0	8.9	-3.9	0.0
Trade					
Tennessee	3.1	5.3	3.7	2.5	2.4
U.S.	2.9	3.1	3.3	2.5	1.4
Services					
Tennessee	4.3	6.0	4.3	4.4	4.9
U.S.	4.7	3.6	4.8	4.5	2.6
FIRE*					
Tennessee	3.9	4.6	2.7	3.1	3.1
U.S.	3.4	3.4	3.8	3.3	2.0
TCPU**					
Tennessee	2.0	2.3	3.2	2.3	2.2
U.S.	1.1	1.7	1.4	1.0	0.2
Government					
Tennessee	4.3	3.6	4.1	0.6	1.2
U.S.	4.2	2.9	2.5	1.0	1.1

*Finance, insurance, and real estate
**Transportation, communications, and public utilities

Tennessee Jobs

An alternative indicator of economic performance is the rate of job creation and growth. In Table 4, compound annual growth rates in nonagricultural jobs are presented for various sectors of the Tennessee economy and the U.S. economy. As with the output growth rates discussed above, these are measured from peak to peak of the business cycle and from beginning to end of the long-run forecast period.

The compound annual growth rate in state jobs is forecast to be 2.4 percent, whereas for the U.S., job growth will be only 1.4 percent between 1988 and 1997. These somewhat lower growth rates relative to the various historical reference periods in part reflect significant demographic changes, including lower rates of increase in labor force participation and the end of the Baby Boom era.

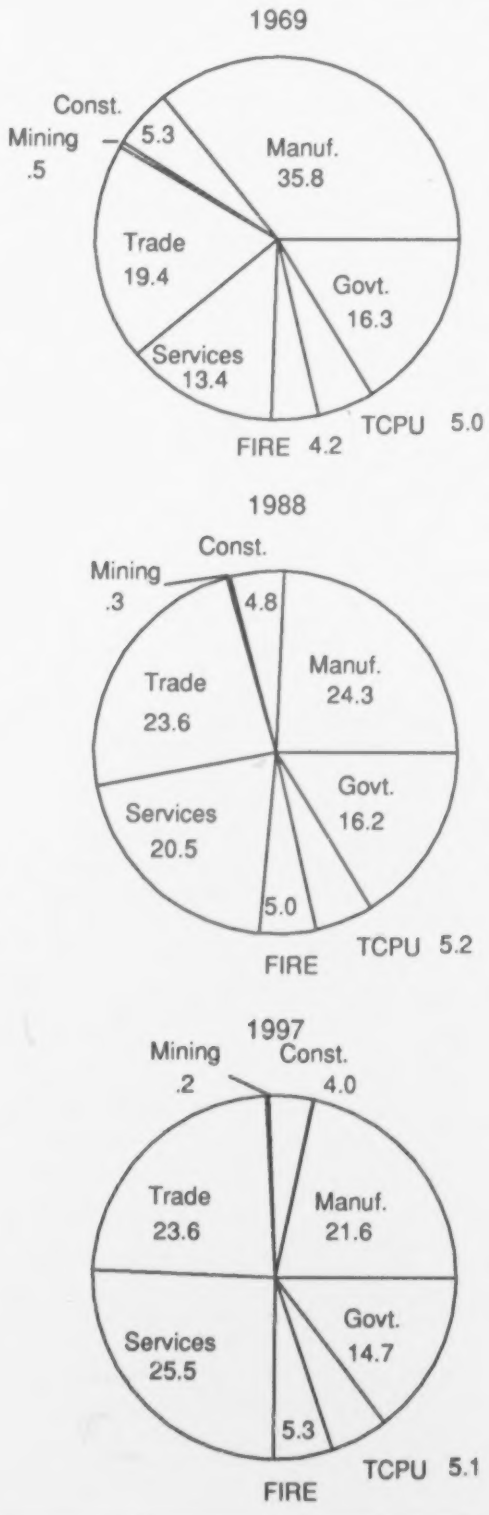
Manufacturing sector jobs, which comprised 24.3 percent of all state nonagricultural jobs in 1988 (see Figure 12), will grow at a 1.0 percent rate for Tennessee, as opposed to a decline of 0.3 percent for the U.S. economy. For the state, this reflects significant improvement over the experience of the last decade.

Durable goods manufacturing job growth will amount to 1.8 percent on a compound annual basis over the forecast period. State job growth will be led by the transportation equipment sector (4.2 percent), followed by instruments (3.4 percent), miscellaneous durable goods (3.4 percent) and nonelectrical machinery (3.2 percent). The only durable goods sectors to experience job contraction will be lumber and wood (-0.7 percent) and stone, clay and glass (-1.8 percent). For these latter two sectors, the number of 1997 jobs will approach the levels that prevailed in 1960.

In the nondurable goods manufacturing sector, the compound annual growth rate in state jobs will be only 0.2 percent over the forecast period. While relatively small, this increase represents a significant improvement over Tennessee's experience between 1973 and 1979, and 1979 and 1988. Negative rates of job growth will occur in chemicals (-2.4 percent), apparel (-1.2 percent), leather and leather products (-1.0 percent), textiles (-0.8 percent) and "other" nondurables (-0.5 percent). Job contraction in these sectors will have a pronounced cumulative effect by 1997. For example, by 1997 the number of jobs in textiles will be two-thirds of 1960 levels; jobs in apparel will decline to 1964 levels; in chemicals, the number of jobs will have diminished to two-thirds of 1960 levels; and in leather and leather products, the number of jobs will be only one-half of 1960 levels.

Displacing these nondurable goods sectors in relative importance have been paper, printing and publishing, and rub-

FIGURE 12
Percent Distribution Of Tennessee Nonagricultural Jobs



ber and plastics. Over the forecast period, job growth for the latter three sectors will amount to 0.2 percent, 2.7 percent, and 0.8 percent, respectively.

Within the nonmanufacturing sectors of the Tennessee economy, job growth in construction (0.2 percent) and in mining (-1.6 percent) will, as was the case for output growth, lag behind the U.S. between 1988 and 1997. For the remaining sectors, including trade (2.4 percent), services (4.9 percent), FIRE (3.1 percent), TCPU (2.2 percent), and government (1.2 percent), the state's performance will surpass that of the U.S.

The relative importance of these major sectors in terms of Tennessee jobs is illustrated in Figure 12, where the percent distribution of nonagricultural jobs is presented for 1969, 1988, and 1997. A most significant trend has been the decline in the relative importance of the manufacturing sector. (Recall that manufacturing sector output has, with some variation, increased its contribution to total state nonagricultural output). In 1969, manufacturing sector employment comprised 35.8 percent of all state nonagricultural jobs, as compared with 28.7 percent for the U.S. (not shown). In 1988, the manufacturing sector's share of state nonagricultural jobs declined to 24.3 percent (as opposed to 18.5 percent for the U.S.) and in 1997 will account for 21.6 percent of state nonagricultural jobs (versus 16.0 percent for the U.S.).

As with output, manufacturing employment has been increasingly dominated by the durable goods sector. In 1969, jobs in the durable goods sector accounted for 41.9 percent of all manufacturing jobs. By 1997 this rate of contribution is projected to increase to 53.0 percent for Tennessee.

The construction, mining and government sectors have also diminished in relative importance over the time frames depicted in Figure 12, although absolute employment levels have increased relative to 1969. As these sectors have experienced declines in relative importance, jobs in trade, services, FIRE and TCPU have increased in relative importance. The most significant rate of job growth has been in services, which by 1997 will account for one of every four nonagricultural jobs in the state. ■

TENNESSEE ECONOMIC OVERVIEW

The Tennessee composite index of leading indicators held steady in December, at 109.9. This places the annual average of the index only 0.4 percent above the annual average for 1987, which is the slowest annual growth rate since 1982. The only month of increase during the last half of 1988 was November, and the first half of the year witnessed three months of increases and three months of decreases. Hence, overall performance of the index during 1988 was quite sluggish, and the current trend in the index remains flat.

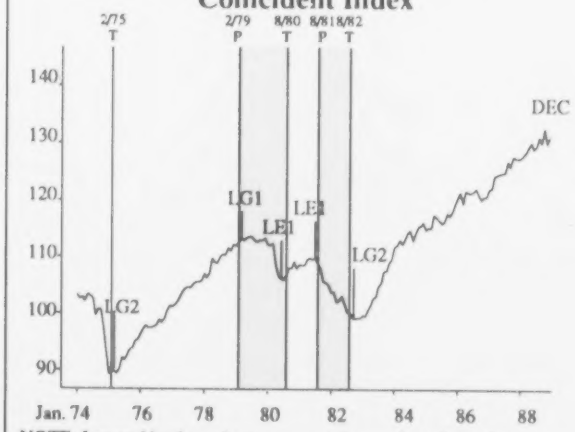
As has been the case in recent months, the components of the leading index displayed diverse behavior during December, with three components indicating growth and two components indicating stagnation. Seasonally adjusted real taxable sales increased for the second straight month in December. The December increase was 3.0 percent at a seasonally adjusted annual rate (SAAR) and followed a very sudden increase in November. The U.S. leading index also increased in December, at a 7.7 percent SAAR, which more than offsets the decrease in November. This continues a recent pattern of ambiguity in the U.S. leading index, since it has alternated increasing and decreasing each of the past 8 months. At this time, the major strength of the Tennessee economy is the continued growth of the U.S. economy, so the lethargic behavior of the U.S. index makes the outlook for Tennessee questionable. Initial claims for regular Tennessee unemployment insurance also helped buoy the Tennessee leading index in December, decreasing by 9,300. However, large decreases in seasonally adjusted construction starts and real taxable mortgages held the leading index down. Both of these components' annual averages decreased during 1988, with taxable mortgages declining by 6 percent and construction starts decreasing by 0.7 percent.

The Tennessee composite index of coincident indicators increased 9.0 percent at a SAAR during December, from 120.0 to 120.9. This does not offset the decrease that took place in November, but still places the index 2.4 percent above December of 1987. Overall, the coincident index showed sustained growth during 1988, and ended the year with a 2.9 percent annual average growth rate. This compares favorably with the 2.9 and 2.8 percent average growth rates of 1986 and 1987.

All three components of the coincident index increased during December. Seasonally adjusted commercial and industrial electricity consumption increased by 31.6 percent at a SAAR and ended the year with a 6.7 percent annual average growth rate. The Memphis help-wanted advertising index increased as well, but the increase was only 1 index point. Help-wanted advertising in Memphis was flat on average for 1988, increasing only 0.4 percent. Finally, the U.S. coincident index continued its recent growth trend, increasing by 9.0 percent at a SAAR in December, which brings the annual average growth rate for 1988 to 4.8 percent. This is an increase over the 2.7 and 3.0 percent growth rates for 1986 and 1987.

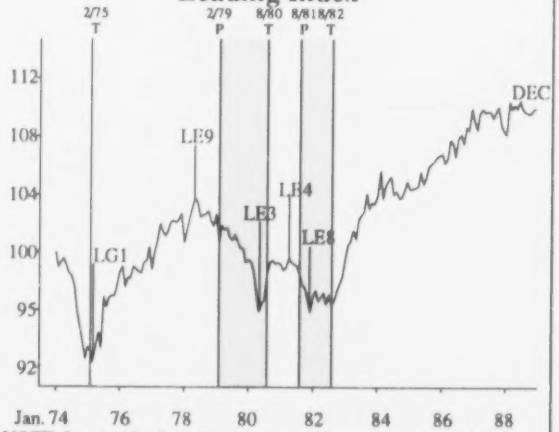
In December, Tennessee's seasonally adjusted nonagricultural employment decreased 7.2 percent at a SAAR, negating almost all of the November increase. The November aberration is due to the temporary hiring of 12,500 election poll workers, and does not signify a trend. Without these employees, employment increased by 2,500 in November but was flat in December. Hence, employment increased by only 0.9 percent from December 1987 to December 1988. The average growth rate for 1988 was 2.5 percent, which is a substantial slowdown from the growth rates of 3.3 and 4.1 percent in 1986 and 1987. Tennessee's 1988 growth rate was also below the U.S. growth rate of 3.6 percent. Despite this, the seasonally adjusted Tennessee civilian unemployment rate decreased to 5.7 percent in December from 6.1 percent in November. Thus, the average for 1988 was 5.8 percent, the lowest rate since 1979. However, the December decrease was largely caused by a decrease in the number of people unemployed rather than an increase in employment.

FIGURE 1
Coincident Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the coincident index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

FIGURE 2
Leading Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the leading index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

TENNESSEE ECONOMIC INDICATORS
SEASONALLY ADJUSTED

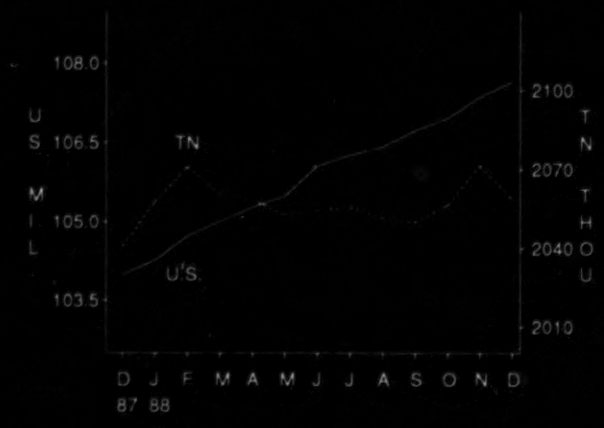
	12/87	1/88	2/88	3/88	4/88	5/88	6/88	7/88	8/88	9/88	10/88	11/88	12/88	1986	1987	1988
US Personal Income (BIL 82 $) (1)	3236.6	3214.6	3235.0	3251.1	3242.3	3243.1	3254.1	3265.5	3270.8	3270.8	3305.5	3293.8	3315.3	3088.3	3163.5	3263.5
% Chg Prev Month SAAR	17.18	-7.88	7.89	6.15	-3.21	0.28	4.18	4.26	1.99	0.00	13.51	-4.17	8.10	3.67	2.43	3.16
% Chg Same Month Last Yr	3.52	3.20	2.93	3.41	3.06	3.20	3.69	3.36	3.27	3.41	2.88	3.12	2.43	3.67	2.43	3.16
US Personal Consumption Deflator (1982=100)	121.7	122.0	122.0	122.6	123.4	124.0	124.3	124.8	125.1	125.8	126.4	126.6	126.9	114.3	119.5	124.5
% Chg Prev Month SAAR	0.99	3.00	0.00	6.06	8.12	5.99	2.94	4.94	2.92	6.93	5.86	1.92	2.88	2.43	4.50	4.20
% Chg Same Month Last Yr	5.00	4.36	4.10	4.07	4.22	4.29	4.10	4.35	4.16	4.14	4.20	4.11	4.27	2.43	4.50	4.20
TN Nonag Employment (THOU) (2)	2040.5	2057.6	2070.9	2060.6	2058.3	2052.9	2054.2	2055.7	2051.4	2049.9	2056.5	2071.5	2058.7	1929.2	2008.4	2058.2
% Chg Prev Month SAAR	-0.08	10.55	8.05	-5.80	-1.33	-3.10	0.76	0.84	-2.44	-0.90	3.92	9.13	-7.16	3.29	4.10	2.48
% Chg Same Month Last Yr	4.00	4.22	4.36	3.82	3.49	2.79	2.40	2.31	1.88	1.32	0.92	1.51	0.89	3.29	4.10	2.48
US Nonag Employment (MIL)	104.0	104.3	104.7	105.0	105.3	105.5	106.1	106.3	106.4	106.7	107.0	107.4	107.7	99.5	102.3	106.0
% Chg Prev Month SAAR	3.80	3.05	5.51	3.39	3.02	2.40	6.66	2.45	1.75	3.58	2.69	4.63	3.16	2.06	2.79	3.64
% Chg Same Month Last Yr	3.41	3.44	3.68	3.71	3.61	3.59	3.90	3.75	3.66	3.72	3.48	3.57	3.51	2.06	2.79	3.64
TN Unemployment Rate (%) (2)	6.1	6.2	5.7	5.6	5.5	5.5	5.6	5.8	6.0	6.2	6.2	6.1	5.7	8.0	6.6	5.8
US Unemployment Rate (%)	5.6	5.8	5.7	5.6	5.5	5.6	5.4	5.4	5.6	5.4	5.3	5.4	5.3	7.0	6.2	5.5
Bank Prime Interest Rate (%)	8.8	8.8	8.5	8.5	8.5	8.8	9.0	9.3	9.8	10.0	10.0	10.1	10.5	8.3	8.2	9.3
US Coincident Composite Index (1967=100)	174.4	173.7	175.0	176.1	176.0	176.4	177.7	178.3	178.9	178.9	180.7	180.8	182.1	164.7	169.7	177.9
% Chg Prev Month SAAR	13.26	-4.71	9.36	7.81	-0.68	2.76	9.21	4.13	4.11	0.00	12.76	0.67	8.98	2.73	3.05	4.81
% Chg Same Month Last Yr	4.18	4.89	4.04	4.82	4.76	5.25	5.65	5.01	4.87	4.80	4.45	4.75	4.42	2.73	3.05	4.81
US Leading Composite Index (1967=100)	190.8	189.8	191.4	191.7	192.2	190.9	193.7	192.3	193.4	192.7	193.7	193.4	194.6	179.3	189.4	192.5
% Chg Prev Month SAAR	4.51	-6.11	10.60	1.90	3.18	-7.82	19.09	-8.34	7.08	-4.26	6.41	-1.84	7.71	6.30	5.68	1.61
% Chg Same Month Last Yr	2.20	2.32	2.90	2.19	2.45	1.22	1.68	0.73	0.89	0.42	0.83	1.74	1.99	6.30	5.68	1.61
TN Coincident Composite Index (1/74=100)	118.1	118.2	118.6	119.0	119.6	120.2	119.3	119.7	120.8	120.1	122.1	120.0	120.9	113.3	116.5	119.9
% Chg Prev Month SAAR	-0.88	1.05	4.34	4.05	7.05	5.33	-7.81	3.55	12.11	-6.82	21.12	-18.30	8.95	2.92	2.81	2.93
% Chg Same Month Last Yr	4.47	3.59	3.91	2.76	3.16	3.53	2.71	3.01	2.67	2.67	3.17	1.60	2.40	2.92	2.81	2.93
TN Leading Composite Index (1/74=100)	108.5	108.2	110.5	109.9	110.2	110.0	110.5	109.9	109.7	109.6	109.6	109.9	109.9	107.7	109.4	109.8
% Chg Prev Month SAAR	-3.86	-3.24	28.34	-5.65	3.30	-2.65	6.10	-5.97	-2.54	-0.94	-0.33	3.71	0.13	2.13	1.58	0.40
% Chg Same Month Last Yr	-1.34	-0.89	1.79	0.27	0.29	0.28	0.70	0.20	0.40	-0.11	-0.45	1.01	1.35	2.13	1.58	0.40
TN Comm & Ind Elect Consumption (MIL KWH) (3)	2185	2192	2194	2207	2216	2212	2196	2226	2260	2257	2309	2241	2293	24326	25129	26802
% Chg Prev Month SAAR	-3.45	4.21	0.95	6.99	5.35	-2.42	-8.01	17.35	19.95	-1.19	30.90	-30.10	31.60	3.66	3.30	6.66
% Chg Same Month Last Yr	11.60	10.89	11.72	6.98	8.11	5.02	2.56	6.94	7.57	6.40	7.48	2.26	4.93	3.66	3.30	6.66
Help Wanted Index,Memphis (1967=100) (4)	136	139	140	140	149	156	141	140	150	140	155	134	135	125	143	143
% Chg Prev Month SAAR	-45.24	29.93	8.98	0.00	111.20	73.48	-70.27	-8.19	128.85	-56.30	239.19	-82.57	9.33	16.60	13.91	0.41
% Chg Same Month Last Yr	12.40	0.00	6.06	-2.10	0.66	9.09	2.17	0.00	-4.46	-2.10	3.33	-6.29	-0.74	16.60	13.91	0.41
TN Mfg Employment (THOU) (2)	500.4	503.5	503.2	499.9	498.9	497.5	498.1	498.7	498.6	496.8	498.2	499.0	500.9	490.4	495.4	499.4
% Chg Prev Month SAAR	-2.55	7.49	-0.74	-7.58	-2.21	-3.50	1.67	1.35	-0.20	-4.30	3.45	1.95	4.64	-0.42	1.02	0.81
% Chg Same Month Last Yr	1.64	2.29	2.17	1.38	1.39	1.08	0.84	0.99	0.72	0.07	-0.74	-0.50	0.09	-0.42	1.02	0.81
US Mfg Employment (MIL)	19.3	19.4	19.4	19.4	19.5	19.5	19.5	19.6	19.6	19.5	19.6	19.7	19.8	19.0	19.1	19.5
% Chg Prev Month SAAR	3.22	1.31	1.31	0.93	3.45	1.87	3.38	3.05	-2.00	-0.67	6.25	4.36	2.09	-1.53	0.52	2.49
% Chg Same Month Last Yr	2.39	2.64	2.58	2.60	2.73	2.74	2.96	2.75	2.35	2.05	2.20	2.18	2.09	-1.53	0.52	2.49
TN Mfg Avg Weekly Hours (2)	42.1	42.5	41.8	41.9	41.9	41.6	41.7	41.6	41.4	41.5	41.2	41.3	41.4	41.2	41.6	41.7
% Chg Prev Month SAAR	-0.58	13.36	-17.48	2.37	0.09	-7.69	1.54	-3.20	-6.19	4.37	-8.12	1.81	3.70	0.63	0.82	0.20
% Chg Same Month Last Yr	2.04	2.54	-1.62	1.20	3.27	0.47	0.61	0.00	-0.72	1.77	-1.44	-1.93	-1.58	0.63	0.82	0.20
TN Taxable Sales (MIL $) (5)	3217	3167	3320	3335	3337	3328	3421	3299	3274	3319	3248	3383	3402	35352	37578	39833
% Chg Prev Month SAAR	44.39	-17.38	76.42	5.44	0.91	-3.17	38.98	-35.41	-8.47	17.62	-22.88	63.03	7.21	7.81	6.30	6.00
% Chg Same Month Last Yr	5.27	5.71	11.39	9.12	8.47	6.64	8.70	3.18	2.22	5.23	-1.84	8.41	5.75	7.81	6.30	6.00
TN Taxable Sales (MIL 82 $) (5)	2644	2596	2721	2720	2704	2684	2752	2643	2617	2638	2569	2672	2681	30917	31448	31999
% Chg Prev Month SAAR	42.97	-19.79	76.42	-0.58	-6.67	-8.64	35.01	-38.45	-11.07	10.01	-27.16	59.97	4.21	5.25	1.72	1.75
% Chg Same Month Last Yr	0.25	1.29	7.01	4.85	4.08	2.26	4.42	-1.12	-1.87	1.04	-5.80	4.13	1.42	5.25	1.72	1.75
Initial Claims For TN UI (THOU) (2)	42.7	38.1	32.8	35.9	30.9	33.3	33.9	29.8	38.7	36.3	35.6	39.6	30.3	511.2	437.4	415.1
% Chg Prev Month SAAR	1479.4	-74.2	-83.5	187.7	-83.4	151.5	21.7	-78.2	2148.3	-54.0	-20.3	256.2	-96.0	-5.2	-14.4	-5.1
% Chg Same Month Last Yr	5.92	-0.90	-19.48	-9.17	-18.98	-0.94	-7.77	-24.95	27.63	10.61	15.87	16.57	-29.15	-5.22	-14.42	-5.11
Continued Weeks Claimed For TN UI (THOU) (2)	165.9	170.5	176.2	186.3	157.2	170.5	167.6	149.5	201.2	166.9	171.1	198.5	146.9	2300.5	2058.4	2062.4
% Chg Prev Month SAAR	29.0	38.7	49.0	94.5	-86.9	163.9	-18.3	-74.7	3425.4	-89.4	34.5	495.4	-97.3	-3.8	-10.5	0.2
% Chg Same Month Last Yr	-13.92	-3.91	1.88	1.27	-8.47	1.62	-10.11	-13.85	19.76	-4.34	11.26	22.21	-11.45	-3.79	-10.52	0.19
Total TN Construction Starts (6)	427.6	329.0	452.3	441.0	433.2	467.8	498.7	400.5	459.2	447.5	425.6	487.5	437.3	5257.2	5318.0	5279.6
% Chg Prev Month SAAR	24.4	-95.7	4456.9	-26.1	-19.2	151.4	115.2	-92.8	417.6	-26.8	-45.2	409.8	-72.9	-12.5	1.2	-0.7
% Chg Same Month Last Yr	-9.21	-28.39	19.47	-15.66	-4.16	2.26	3.21	-20.21	36.63	3.41	-4.62	16.09	2.26	-12.50	1.16	-0.72
Value Of TN Constrc Starts (MIL 82 $,NSA) (6)	276	185	252	315	367	355	371	311	404	308	335	278	314	3997	4279	3797
% Chg Prev Month SAAR	-36.8	-99.2	3991.1	1332.0	523.7	-32.6	70.6	-88.2	2287.5	-96.1	169.9	-88.9	309.8	1.4	7.0	-11.3
% Chg Same Month Last Yr	-21.25	-37.70	-7.39	-21.96	-2.39	-12.60	-25.46	-25.56	49.87	-13.23	-20.51	-2.60	13.82	1.39	7.05	-11.28

	85/IV	86/I	86/II	86/III	86/IV	87/I	87/II	87/III	87/IV	88/I	88/II	88/III	88/IV	1986	1987	1988
US GNP (BIL 82 $) (1)	3662.4	3719.3	3711.6	3721.3	3734.7	3776.7	3823.0	3865.3	3923.0	3956.1	3985.2	4009.4	4029.2	3721.7	3847.0	3995.0
% Chg Prev Qtr SAAR	2.96	6.36	-0.83	1.05	1.45	4.57	4.99	4.50	6.11	3.42	2.97	2.45	1.99	2.85	3.37	3.85
% Chg Same Qtr Last Yr	3.60	3.96	3.12	2.35	1.97	1.54	3.00	3.87	5.04	4.75	4.24	3.73	2.71	2.85	3.37	3.85
TN Personal Income (MIL $) (1)	55075	56168	56928	58044	58950	60637	61636	62864	64992	64924	66562	NA	NA	57523	62532	NA
% Chg Prev Qtr SAAR	9.90	8.18	5.52	8.08	6.39	11.95	6.75	8.21	14.24	-0.42	10.48	NA	NA	7.16	8.71	NA
% Chg Same Qtr Last Yr	6.74	7.01	6.67	7.91	7.04	7.96	8.27	8.30	10.25	7.07	7.99	NA	NA	7.16	8.71	NA
TN Personal Income (MIL 82 $) (1)	48696	49531	50113	50605	50951	51694	51839	52300	53491	53129	53722	NA	NA	50300	52331	NA
% Chg Prev Qtr SAAR	5.69	7.04	4.78	3.99	2.76	5.96	1.12	3.60	9.43	-2.68	4.54	NA	NA	4.60	4.04	NA
% Chg Same Qtr Last Yr	3.16	3.99	4.42	5.37	4.63	4.37	3.44	3.35	4.99	2.78	3.63	NA	NA	4.60	4.04	NA

1. Annual Rate.
2. Calculated from data provided by the Tennessee Department of Employment Security.
3. Source: Tennessee Valley Authority.
4. Source: The Conference Board.
5. Calculated from sales tax collections, provided by the Tennessee Department of Revenue.
6. Source: F.W. Dodge Division of McGraw-Hill Information Services Company.

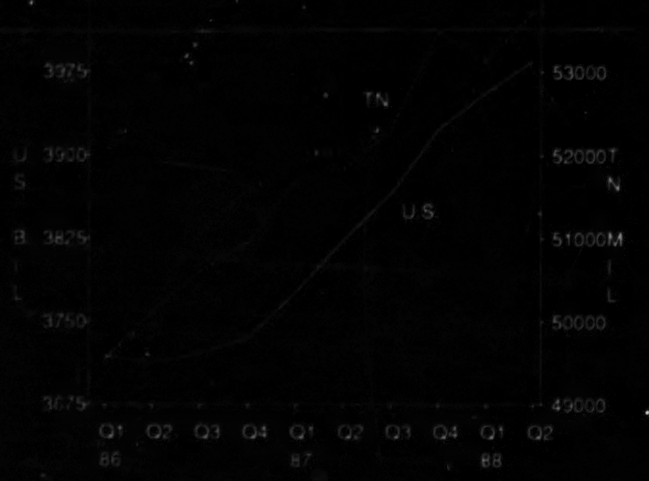
Percent Change in the U.S.
Personal Consumption Deflator
Seasonally Adjusted

Total Nonagricultural Employment
Seasonally Adjusted

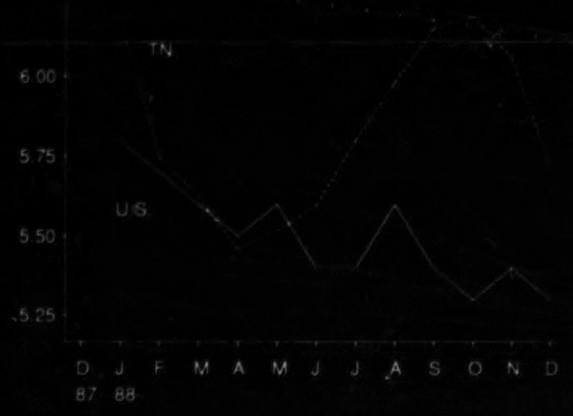


Note: Calculated from data provided by the Tennessee Department of Employment Security.

Real Personal Income
Seasonally Adjusted Annual Rate
1982 Dollars



Civilian Unemployment Rates
Seasonally Adjusted



Note: Calculated from data provided by the Tennessee Department of Employment Security.

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Survey of Business

STRATEGIC LINKAGES IN THE TOTAL QUALITY MANAGEMENT PROCESS

The Institute For Productivity Through Quality

Since the first offering of the Institute for Productivity Through Quality in 1981, the faculty and staff of The University of Tennessee's Management Development Center have worked to expand the body of information associated with statistical management and continuous improvement. The articles in this edition of the **Survey** represent the current thinking of some of the best minds associated with the Center.

It is important to note that while we have focused many of our resources on interactions with external organizations, we have also focused on incorporating these ideas and on generating new knowledge within the Colleges of Business Administration and Engineering, realizing that it is important to us to change our own organizations as we seek to change others. One of the changes is that we are no longer funding the direct development of courses. What we *are* funding is applied research into areas that we believe (based on our own learnings and supported by feedback from our customers) represent the greatest need or potential for new learning. We expect publications, faculty seminars, curricula changes, and additional courses to result from the learning associated with the research in these areas. Areas in which we are currently funding research are listed below:

1) **Measurement and control in continuous process industries.** In the summer of 1989, we are conducting a three-day workshop to address issues relating to measurement and control in the continuous process industries. The work in this field is a joint effort of Institute faculty and the Measurement and Control Center for Excellence faculty from the College of Engineering. This project represents one of two cross-college research efforts we have funded. Another related course is scheduled for 1990.

2) **Superior product development for manufacturability.** Research in this area is still evolving. A faculty member in Engineering with over 20 years' experience with IBM has joined us to work on design issues which plague new product design and development.

3) **Marketing and Customer Value.** In this area, traditional total quality tools are being coupled with new research findings in the area of customer satisfaction to provide the marketing professional the knowledge to become an integral part of a corporate total quality implementation. A course scheduled for January and February of 1990 will incorporate sessions designed to help reduce functional barriers.

4) **Logistics and Transportation.** In the logistics and transportation areas we are working to integrate a number of concepts related to logistics customer service and total quality management. Our goal is to help logistics managers design better logistics and transportation systems. A public course scheduled for next year will be conducted concurrently with the marketing and customer value course. Some joint sessions are planned which we hope will enhance cross-functional communication.

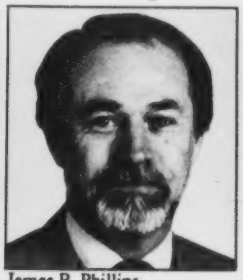
Second, the five courses that make up the Institute for Productivity Through Quality (the Three-Week, Senior Executive, Administrative and Service, Design of Experiments, and Cost Management) continue to be a primary means for disseminating information to the general public. However, as we continually add new material from customer feedback and site observation, and as we develop more case studies and problem-solving sessions, these courses increasingly provide valuable opportunities for our faculty to learn from participants' experiences. Our biweekly institute faculty meetings have become a major vehicle for transferring the new knowledge across faculty and for shaping that knowledge into new course materials.

The result of these new activities is an expanded role for the Institute. Perhaps it is within this larger framework that we will begin to realize greater success with organizational change. Our vision is to help organizations, ours included, grow and change together into the more integrated, competitive and viable organizations demanded by a global economy. The role of the Institute in the future will be to serve as a liaison, resource provider and creative laboratory within which this vision can be realized.

Steven R. Martin and Anne M. Mayeux
Associate Directors, Management Development Center

The UT Management Development Team

John E. Riblett, Director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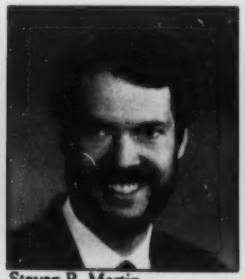
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Survey
OF BUSINESS

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Consulting Editor's Comments

Much has been written about the failure of universities to address their proper role in dealing with the competitiveness dilemma we face as a nation. Dean C. Warren Neel of our College of Business Administration addresses that topic in his article, "Changing the Paradigm," which leads off this issue on the theme, "Strategic Linkages in the Total Quality Management Process." Other articles address some of the major components and issues of total quality management, offering new or different perspectives on traditional paradigms in areas like accounting, marketing, logistics, operations, vendor relations, product development, and organizational development.

Two articles offer a new perspective on the paradigm of management as practiced by many western organizations over the past 50 years. In "Management Leadership in the New Economic Age," G. Harlan Carothers, Richard D. Sanders, and Kenneth E. Kirby challenge managers to rethink their traditional roles as problem solvers and discuss the need to assume major organizational systems responsibilities. In "Seeking Improvement: A Paradigm for Organizational Effectiveness," Mary G. Leitnaker, Gipsie B. Ranney, and Richard D. Sanders discuss the need for continually improving business systems and processes.

In "Reforming the Manufacturing Organization," Robert W. Hall explains the management mind-set needed to effectively transform a manufacturing organization for world-class performance. James M. Reeve, in "TQM and Cost Management: New Definitions for Cost Accounting," looks at new cost accounting roles and definitions as we move from traditional cost accounting to a cost management system. In "Brokering Marketing into Total Quality," William B. Locander formulates the vital role that marketing should play in a total quality management program. In "The U.S. Product Development Dilemma," Clement C. Wilson utilizes his 26 years of product development experience to discuss the problems that currently face U.S. manufacturers in the critical product design and development process and have seriously impacted our competitiveness. In "The Importance of Quality and Continuous Improvement in Logistics Customer Service," James H. Foggin describes the growing importance of logistics in gaining competitive advantage, and "Team Playing: The Select Supplier Program," by Mary D. Dolan, discusses one of the key components (supplier partnerships) of Campbell's total systems approach to quality management.

Lyle Yorks discusses total quality in "Organizational Transformation in Total Systems Quality," while in "Moving Toward Systems Integration," Larry A. Pace offers a model for EI and TQM integration. The final article by Charles F. Moore and Kenneth E. Kirby focuses on issues concerning quality and productivity improvement in continuous process operations.

We at The University of Tennessee feel a strong responsibility to our society in general, to the individuals who make up our society, and to the organizations that make up the industrial and public sectors of our economy. Our internal partnership between the Colleges of Business and Engineering, coupled with the critical external partnerships we have established with firms in the private sector, represent a model that others may use in helping re-establish the U.S. as a global industrial leader. We believe that universities can play a vital role in this process.

We owe thanks to Kenneth E. Kirby of the College of Engineering and Richard D. Sanders and G. Harlan Carothers of our College of Business Administration for their tireless and fruitful efforts in making such partnerships a reality.

John E. Riblett
Consulting Editor

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C. Warren Neel
Dean, College of Business Administration
The University of Tennessee, Knoxville

CHANGING THE PARADIGM

by C. Warren Neel

Suppose you were given the opportunity to design a product for the global marketplace. Further, suppose that you had complete freedom to develop an organization, choose a plant site, purchase equipment, and select the personnel to produce and sell the product. Then suppose that you had the opportunity to locate that facility in a Camelot where you could dictate the cultural norms for both worker and management behavior. What would you do to assure that the product (or service) was marketable?

To be sure, few managers are given the opportunity to design a new plant and a new product from a green field. And just as certainly, the economic and social equivalent of Camelot does not exist. However, let us choose these suppositions to focus our attention on some of the issues facing American management in a global economy.

The U.S. Paradigm

Today's United States management paradigm, the model of organizational governance, has its roots in the culture that grew out of the Industrial Revolution. That model has been refined in the same way as have the machines and equipment used during the last 150 years.

But with all these changes, Americans have held firmly to the underlying philosophy that a worker is completely adaptable to changing technology. As we built larger plants and more complex organizations, the workforce proved that assumption correct. Managerial control was the primary tenet of the paradigm, and that tenet endured. The professional manager saw no need for a fundamental change in philosophy. After all, at the beginning of the Industrial Revolution, management removed the artisan's tools from his hands, replaced them with machinery, and the workforce complied with only a whimper. The changes in the paradigm during this century have been a logical extension of the past -- placing decision making, like the relocated tools, in the hands of management, where

more authority, more knowledge, and more responsibility resided. The issue of where control resided was never debated beyond whether it was to be exercised by central management or decentralized. We even codified the practices of the paradigm's evolution with labels like hierarchy, unity of command, etc. Those labels endured as we passed our experience from one generation of management to the next. Those labels became principles to guide managers who work in complex organizations.

Business and Education

Our higher education institutions, particularly large institutions, and more specifically, professional schools and colleges, promulgated the same model. While factories subdivided jobs, higher education institutions were also busy breaking down fields of study into smaller and smaller specialities. While large, complex organizations were developed to reflect major functions of businesses and markets, professional schools divided their curricula into specialities that identified with those organizational functions. Degree programs in many cases even legitimized the management model by designating bodies of knowledge that the practitioner had learned through trial and error. As new specialities were added, the explosion of knowledge became the rationale for academics.

Like academics, business had its own rationale: a complex, global marketplace and the need for larger quantities of both labor and capital to achieve efficiencies. Business and education became mirror images of each other. Even though the two areas sought the same objective for society, there was never a healthy mutual respect. Even though we looked alike, we chose to act independently: business wanted nothing to do with the starry-eyed professor, and the professor wanted an arms-length distance from businessmen who would compromise the research agenda. Thus, two institutions of society, two potential partners, never found a common ground. That is our history, a history of suspicion in part traceable to the Western European cultural model which suggests that separation of certain institutional powers is better for society than partnerships to address common causes.

At the Crossroad

Today's institutions have reached a crossroad clearly marked with the signs of their own decay. One sign suggests that the American business acumen borne of the European culture is no longer effective. Maybe that is because we are no longer Western European, but American in culture. Whatever American culture might be, we know that it is heterogeneous and that the models of corporate governance in the workplace must change. The current model has served well for the 20th century, but will not serve as well for the economic basis of the 21st century.

A second sign we observe at this intersection suggests that the American educational system that serves so well to foster a democratic society has not made a full contribution to a management paradigm. The sign suggests that the education system which was designed in a time when this nation grew by land expansion and then by migration patterns is not responsive to a new emerging heterogeneous American culture. The education sign also suggests that while broad access to education is the cornerstone of political democracy, that same education has yet to bring forth a management paradigm grounded in the same free will of workers. Because of the Western European preoccupation with control, democracy never came to the workplace. The management philosophy of control suggests that each successive rung on the hierarchical ladder is more knowledgeable and more responsible, and thus the highest rung should have more authority than all the others below them, i.e., the workers. Competition for positions in the hierarchy consumes more of our managerial energies than working on the process of improving the existing product or developing new ones.

A third sign of major importance at this crossroad suggests that American business and political leaders believe that monopolistic competition is appropriate for the world markets but inappropriate

for domestic markets. That logic conveniently fits our history, but not our future. American business was a monopolistic world power for the first 75 years of this century. Now the market is more characteristic of an oligopoly. Obviously, to be effective in a world market, we must reevaluate our logic.

The Traditional Model

Like other American businesses, professional schools are rooted firmly in tradition. Programs are indelibly marked with the same labels as business functions. Professional societies and editorial boards of journals govern the values of the academic culture, leaving college administrators little control over the agents that might introduce change. Over the past four decades, the results of American business in the emerging global market clearly suggests that we are part of the problem. For example, academicians fragmented the curriculum as we became preoccupied with having our faculty conduct research in narrow fields. We were unconcerned about how that research might build a larger mosaic of scholarship. We were unconcerned with bridging the boundaries between disciplines. We believed that we were endowing our students with the process of critical thinking necessary for the discovery of new knowledge. We were convinced that our mission of educating the next generation of leaders was indisputable.

But unfortunately, our conception of a proper education was to encourage depth and specialization. For the most part we gave the students the results of our inquiry, not the ability and understanding of the process of inquiry. As a result, the country has a cadre of highly trained specialists who look for the quick fix to problem-solving or discovery. While academia divided knowledge into smaller and smaller pieces, industry followed suit, both inspired firmly by the tradition that suggests that specialization leads to efficiency, and efficiency to greater output.

As problems grow more complex and hierarchical structures try to respond, it is not hard to imagine why our technical managers fail. Faced with the lack of sufficient breadth for understanding, the manager cannot overcome that deficiency through cooperation with peers or subordinates, since he has been taught that competition is the valued attribute of leadership.

If you came to this crossroad, charged with the responsibility of building this hypothetical plant producing this product or service, and you read these signs, what would you do? Would you have the courage to rethink our philosophies and models? Would you have the courage to readdress the issues differently from the historical dictates? Would you have the intestinal fortitude to go against the tide of business and academic lemmings insistent upon walking over this economic cliff? If you had the courage to change, to rethink, perhaps you could build that plant and produce products for the world market. If you are astute, you will realize that the only effective management paradigm is one that is nurtured by and evolves from the culture, not one that is lifted without modification from some other culture. But the inertia fostered by tradition is difficult to change. It seduces us into believing that we were good once, we remain so now, and (alas) we always will be. Few managers and even fewer American companies and educational institutions have the courage to question the dogma of the past.

Changing the Paradigm

We at The University of Tennessee, Knoxville, along with some company partners, are making an effort to address these issues, not just for the sake of being different, but for the sake of making a difference. With our business partners, we are developing management models based on a different paradigm. We are addressing issues and developing a perspective that is nontraditional.

The academic portion of the partnership is between the Colleges of Engineering and Business, bringing together a group of faculty representing disciplines that normally have no interaction, doing research and applying that research in the real world laboratory of our private sector partners. The research and field testing vehicle is executive education. It is from this area that we can bring faculty from various disciplines and from the private sector. Much of what is learned is then offered to various curricula committees and thus, regular degree programs are infused.

The revolution is, in a sense, occurring from the outside in, not from the inside out. This seems paradoxical, since most professional colleges in the U.S. see their continuing education programs as completely separate from the regular credit offerings and as a place for only academics to teach. The Tennessee model suggests that it is a laboratory where both partners are simultaneously student and faculty.

The new organizational model emerging at Tennessee tries to get beyond these traditions. Interdisciplinary teams focusing on issues of breadth is a major theme. Each faculty member brings a specialty, but without hierarchy, and without the ownership of a solution, since the process of inquiry and critical thinking is constrained by traditional management models.

We are encouraged by our partnerships outside the University. Corporate partners unwilling to compromise the academic mission or the independence of the research agenda have become committed to the same ideals that are exciting to us. These partners are stakeholders in developing the paradigm. They realize that both parties of the partnership need to maintain their respective independence. Yet each party is becoming increasingly aware that independence does not mean lack of appreciation and understanding of the challenges. Rather, it means a commitment to a common agenda and a common concern for the nation's welfare.

We have been enriched immensely by this partnership, and the articles in the following pages bear adequate testimony to the importance of this continuing endeavor. ■

MANAGEMENT LEADERSHIP IN THE NEW ECONOMIC AGE

by G. Harlan Carothers, Jr., Richard D. Sanders, and Kenneth E. Kirby

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Management, as Americans have historically helped define it, is no longer viable in its current form. Times and circumstances demand new approaches and some traditional practices must be discarded. Management will never again be limited to "Getting things done through others." Management activities will never again be paraphrased adequately as "planning, organizing, staffing, controlling, directing, and evaluating."

These concepts have served well in the past, but they are now grossly insufficient. Even to the extent that they retain usefulness, it becomes more and more obvious that the naive simplicity of their description misses markedly the sophistication and subtlety with which they must be practiced in today's world.

Economic Evolution

It is widely recognized that major segments of the manufacturing base in the United States are unable to meet international competitive product quality or price pressures. International trade data reflect the decline in competitive abilities and achievements; industrial and financial results and other data reveal the abandoned product lines, discarded and undeveloped technologies, lost jobs, and diminished markets. These well-documented, unfavorable changes are not small, random deviations from long-run trends, but instead signal fundamental changes in business capability and potentiality, here and abroad.

It is certain that corporate success can no longer be assured by high growth rates in constantly expanding national markets which experience only limited competition from abroad. A long tradition of relatively protected national markets is changing as industrial companies from throughout Asia, Western Europe, and Latin America enter international commerce with products targeted at numerous markets. Markets are

now world-wide and competition is intense, constant, and unremitting. Competitor management groups strategically have combined price, quality, and product variety and have created consumers throughout the world who demand increased value in products and services. These same management groups appear to have built business systems which consistently deliver these constantly improving products and services.

In a basic sense, an orientation toward customer value is not new. Some generations ago, business men and women knew, deeply and personally, that it was the relative quality and price of their goods that determined whether they sold and sales determined whether they ate.

But over time, with growth in business size, shifts and diffusion in business ownership, and the development of professional business leadership, fundamental principles appear to have been lost. A philosophy and practice evolved which suggested a business could be good at quality but only at the expense of price, or low in price only at the expense of quality. As recently as 1985, business strategy experts pointed to the incompatibility of these generic strategies. But events have proven that organizations with the lower costs, not necessarily lower prices, and higher quality most often possess highest market share and highest profitability.

It is one thing to recognize that value is the imperative; it is another to translate that into strategy and tactics. It is too easy to decide that two factors, cost reduction and quality improvement, are the basic determinants of customer value. In a competitive environment, the discovery and delivery of what constitutes constantly improving value from the customer's viewpont becomes the puzzle. The simplicity of this statement should not disguise or distort the complexity involved in a management group's understanding the axiom and acting accordingly.

Axiomatic Imperative

Managers must accept personal responsibility for the continuous improvement of customer value. While there is apparently widespread verbalization and public agreement on this point, there remains a complex superficiality about the apparent acceptance. There is evidence that managerial behavior currently is inconsistent with and often contradictory to this requirement. That management groups find it contradictory to strategically and tactically address cost, schedule, and quality simultaneously is not only indicative of the difficulty implicit in that requirement but it also signals organizational schizophrenia arising from indecision, uncertainty, and mistrust. It is also commonplace to observe that many senior managers choose to manipulate their firms' investment portfolios rather than undertake the decidedly more difficult task of personally managing the reconstitution of their organizations for engagement in the new competition.

The creation of value as an organizing principle and as a measuring rod of efficiency can be utilized by management at every level of the organization and at every stage of operation. This is because the principle applies whether the customer is internal to the organization or external to it.

While preoccupation with portfolio can be defended as serving the immediate interests of stockholders, an operational philosophy that turns on the enhancement of customer value serves the long-term interests of all components of the organization and those of the broader society as well. It is noted parentheticallly this long-term perspective is a requirement of the new paradigm.

Those firms that do not provide value, by inability, inattention, or choice, will be selectively eliminated by the customer at the point of purchase. The implications are clear: the organization's objective in the 21st century will be to become increasingly valued by the user of their products or services, and this principle holds for producers of both industrial and consumer goods.

Among those primary characteristics determining user value are the following: quality, expressed as confirmed user-valued features of products or services and their consistency; cost, the financial sacrifice required of the user; and schedule, the delivery of those valued features in the correct quantity, time, and place. This understanding will give guidance to management as it restructures firms for the new competition. Consumer issues will therefore form the basic context for the new management paradigm. Managers' fundamental responsibility therefore will be to continuously know what is valued by the user and to create and continually improve organizational systems which, when used by organizational members, create increased user value. The creation of value as an organizing principle and as a measuring rod of efficiency can be utilized by management at every level of the organization and at every stage of operation. This is because the principle applies whether the customer is internal to the organization or external to it.

In adopting the new imperative, management leadership will find it necessary to confront the organization in its basic design and themselves in terms of their personal behavior.

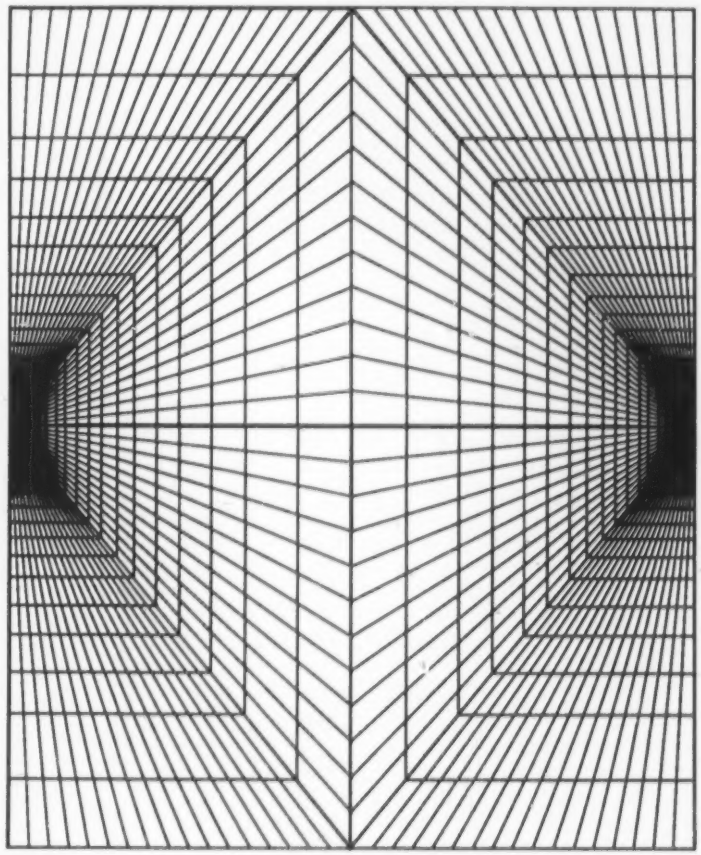
Management Behavior and Organizational Design

It is clear that this critical intention and commitment to the continuous creation of customer value becomes the dictum for managerial leaders. It must become what, in the main, they do, and managerial reward must be predicated on its demonstration.

Cultural and organizational issues of long standing will have to be addressed in order for managers to begin to focus upon their responsibilities according to the new imperative. Management practice of these fundamental activities takes place within an environment shaped and subjected to other strong influences. In the United States there is a dominant organizational hierarchy, a continuous "top down" control, reinforced with strong financial and budgetary considerations and by formal and informal expectations regarding individual conduct at respective levels. Formal degrees of flexibility are reduced as one moves down in the hierarchy and away from the primary management groups.

The key parameters for managerial results may be spelled out in various ways, but they can be translated into volume, cost, and schedule. These have served as a focal triad around which management groups develop and deploy coherent strategies and tactics. The broad acceptance of these dictates makes it possible to promote, recruit, and grow management groups which successfully practice that which is accepted. Obviously, quality has not been ignored and there has been an understanding, often unspoken, as to where that attribute set in the larger scheme of respective strategies. Powerful cultural behaviors are at work in these daily and monthly practices; they cannot be superficially addressed nor can they be ignored as the senior management attempts to redirect the organization and recast its habits.

The organizations themselves must be reshaped to support a competitive focus based upon customer value. This requires an entirely new perspective which views organizations as composed of systems, conveniently but unimaginatively described as cross-functional systems. The system concept can be represented, if incompletely, by use of Adam Smith's famous example that productivity is enhanced by a division of labor based upon specialities. In Smith's pin factory, the several specialists, the wire cutter, the point sharpener, and the head fashioner, illustrating functional separation, all worked in close proximity to each other; they could communicate, exchange ideas, encourage, advise, and cajole each other. Each performed a function, but each undoubtedly saw himself as part of the system of pin manufacture. The system is simply and dramatically captured, but it is incomplete in that described form because it represents only a portrayal of the division of the production into separate steps. That division, of course, still exists, but it is further complicated by marketing, purchasing, and other functional divisions.



But the system of pin manufacture is still there, informal, unrecognized and largely unmanaged. The customer may be remote, but the customer's demands for function, quality, and price must be served. Management must know what it is about the pins that the customers value; marketing does not sell a part number, it sells a set of attributes. Marketing must close the loop from customer to design engineer by knowing and describing to the engineers what is valued about the pins in order to improve the current product and to enable design improvements for the next generation. Engineering, manufacturing, and marketing are the system; the separate names are there for today's understanding. By specific recognition and management of the integrated system, the business approach, direction, and evaluation might be different. Material and parts would be acquired according to a priority for output replication, schedule, and cost. The system would be constructed by management so that it consistently replicates the required products with respect to well-defined criteria. The system would be required to exhibit short lead times in market forecast, factory work orders, and material control and is, therefore, flexible regarding marketing change in mix, quantity, and quality. Marketing would know the sale's rate and be able to predict change and magnitude. The system would be built with a level of equipment that is consistent with product characteristics, employment considerations, and financial return. Equipment purchases are consistent with corporate

marketing, engineering, and manufacturing strategy; a given goal of automation would be consistent with other issues.

Historical Functionalization and New Age Systems

Obviously, a demand-tracking flexible-replication system of the type described above is different from a historical functional unit model built on a division of labor. The attempt to manage systems will require management to reexamine functional responsibilities. The current dominant concept of a corporate organization is the division of the firm into functional disciplines. Business functionality, with each discipline having its own leaders, responsibilities, and interests, represents the organization's expression of specialization. The original rationale for functional unit organizations required the aggregation of specialists in order to achieve efficiency. To some extent, the function's task descriptions have become the rationale and defense for their conduct and continued existence; functional efficiency has become an end in itself.

With today's firm, specialists are hired into functional groups, work in those groups, and are managed by them. The work spaces of the several specialties are not in close proximity. It is no surprise, then, that a hallmark of current firms is the absence of communication among what are viewed as the basic components. This fact precludes firms from effectively utilizing customer value as its managerial orientation. There have been many positive attributes associated with specialization as recognized and encouraged by departmental organizations. However, debilitating and habitual weaknesses also are apparent. Organizational fissures between departments regarding communication, association, and cooperation, critically affect the organization's ability to respond swiftly, consistently, and holistically to corporate needs. The functional departments may be optimized, perhaps in some local sense, but the cost might be a damaging suboptimization for the total organization.

There is no doubt that improved communication would improve matters, but senior management cannot simply will that there be better communication. Improved communication must serve a larger purpose and it must be buttressed by structure, strategy, and tactics. However, many of those issues may be successfully addressed and there would still be an incompleteness; the focus and content of the improved communication must be understood and practiced. It is functional work habits, functional loyality, and functional purpose which must be addressed.

Products and services are completed across functions. A cross-functional management approach is required; the functions must become subservient to the larger organization. Managers will have to change the mind-set of involuntary servitude to function and to professional discipline. The current reward systems are set within and by the functions; paradoxically, the urgently needed behavior for both manager and nonmanager is across the current functions.

Firms that are organized on the basis of functional disciplines and led by executives who do not intimately know the product, the processes, or the customers are unlikely to successfully face up to the new competition. Because the new competition is based on providing value to the customer, systems must be devised that are constantly tuned to what customers value and systems must be devised to design and produce that which is valued. What is implied is a cross-sectional view that is horizontal and necessarily requires more than communication and collaboration across and among all of the functional disciplines. Cross-functional systems are the inate means from which value is derieved. Their effectiveness provides competitive differentiation and advantage. That this horizontal, systemic view is necessarily permanent, not subject to transitory whim, is implicit in the fact that the new competition will require that even more customer value be provided tomorrow than is necessary today.

Managerial Leadership and Organizational Roles, Responsibilities, and Relationships

For organizations to continuously contribute to user value, the managers' roles, responsibilities and relationships in the management of systems must include several basic principles. Managers must provide nonmanagers with systems that work, an objective which can be operationally defined and which can be objectivly evaluated. Managers must understand that variation (its causes and effects) provides a framework for the analysis and improvement of systems. Managers must assume ownership of systems, which means accepting responsibility for understanding, creating, standardizing, and continuously improving systems. Managers will have to understand that systems must be continually reconceptualized and reconstituted to effect improvement; just as athletic records are made to be broken, existing systems must be challenged and replaced by better systems which can be proven to be even more appropriate to the continuous creation of value.

Management will be held responsible for understanding the causal elements in systems and processes. Quality, schedule, and cost are outcomes and therefore are dimensions for assessing all systems. There are no systems for quality, cost, and schedule in and of themselves. There are numerous interdependent systems which tend to impact upon those considerations. It is management's job to understand the systems, relative to causes of valued outcomes and their leverage points, and to devote resources and attention to those criticalities.

Managers must also put in place communication systems that enable nonmanagers to provide information regarding the adequacy of system function, and to support and require suggestions for improvement of organizational systems; it is, however, the fundamental responsibility of management to assess, standardize, and implement purposeful system change. Systems are to be configured by

owner-managers; this responsibility cannot be delegated.

There are other attributes expected of managers: configuring, maintaining, and managing system change. The necessity to problem-solve and to engage in fire fighting will be considered as evidence of a system's management deficiency. Work done on existing systems by management should be directed toward preparation for system improvement. Organizational culture and design must not support, condone, or encourage the building of managers' careers based upon reactive problem-solving, but rather upon demonstrated success in the management and improvement of organizational systems.

There will be different and enlarged roles for the traditional nonmanagement groups. The organizational culture and design must require and encourage nonmanagers to understand and maintain standards, problem-solve, improve functional activities and provide information to managers regarding the functioning and improvement of systems. This is, by and large, new responsibility for nonmanagement groups in corporate culture. It will be management's responsibility to turn over to the nonmanager groups systems which function as planned and which provide the organization with what is needed. The continuous improvement of these systems is management's unique responsibility; this burden cannot be avoided or passed to other people in the organization. Because of the complexity and magnitude of this work and because of the need for the continued practice of various administrative activities, the management groups will pass some traditional responsibilities and duties to nonmanagement groups. There are daily administrative tasks, currently performed by management, which can be delegated to nonmanagers. The intelligent and deliberate choice of activities and roles is crucial to the organization's ability to correctly function for improvement efforts. Organizations must provide the means of developing managers and nonmanagers which enable them to fulfill these newly expected roles and responsibilities.

Managers will be responsible for identifying, selecting, testing, evaluating, and standardizing that which will be turned over to the nonmanagement groups and that which will be kept. Management will be responsible for developing the total workforce (which includes management itself) to be able to perform these new responsibilities. The provisioning of the organization with capable individuals is another cross-functional system for which management must take responsibility. It is not imagined that this provisioning is to be done simply by hiring and firing people as personnel requirements change. The labor force itself will take on a value of its own; a value enriched by experience, education, and the worth of its practice. If a part of the new competition is redoubled efforts to maintain technological congruence, then crucial differences among competitors will be found in the abilities, skills, motivation, and performance of the workforce. The capability of the personnel system must be consistently increased; one assessment of management will be the rationale, technique, and achievement of incremental improvements in operations, processes, and systems as accomplished by the workforce.

Managers will be responsible for identifying, selecting, testing, evaluating, and standardizing that which will be turned over to the nonmanagement groups and that which will be kept. Management will be responsible for developing the total workforce (which includes management itself) to be able to perform these new responsibilities.

Managers must focus the new and newly recognized systems upon the creation of customer value. This focus is crucial and will require delicate implementation -- delicate, because understanding what contributes to customer value is a difficult and challenging task and also because many managers will be convinced that they are currently fulfilling this responsibility. It will be delicate, also, because translating knowledge as to what customers value into purchasing, manufacturing, and marketing parameters becomes another series of judicious challenges.

Implications Of Previously Attempted Tenative Reforms

Managers must take up the burden of integrating across functional boundaries; it is imperative that functions be made subservient to the larger purpose rather than being the purpose. Cross-functional management is a descriptor that captures the imagination and allows the discussion and analysis for change and reform to continue. But that which is being asked in cross-functional management has been addressed in recent decades by other errant reforms, such as matrix or area management, or in particular industries, program/project management. These tenative organizational structural forms appear to have only indicated what is needed ultimately. The various and respective paths by which analysts come to the cross-functional issues represents the universality of the issue. Recommendations for modifications in current practices grow out of personal experience, perceived need, and implicit recognition as to the degree of difficulty in achieving practical organizational reform. Recognition of the issues implicitly addressed by recommended reforms may suggest that to limit change to reform is insufficient.

Most recent reforms have taken several routes, some dealing with conduct, as in employee participation and participative management, and others dealing with organizational structure. Numerous companies have, for example, cut several layers of management from the organization. This does, in fact. make the organization flatter and have the appearance of more horizontal strength.

These moves, in numerous instances, have had the objective of improving communication in the sense of being able to decrease time required for instructions and information to flow up and down the organization. Adaptation time has probably been decreased as a result of these moves because the remaining few managers can do little other than attend to the maintenance of the current systems. Exacerbating this situation, the organizational functions continue to remain in existance, exerting their usual orientation and self-concern.

Many of the inherent issues correlated with, or flowing from, extreme functional separation, referred to as "gap problems," are being addressed in clever and innovative ways. In product development in some companies, for example, management is forming teams under the direction, authority, and responsibility of a senior manager who is charged with the job of taking the product from inception, development, prototype, testing, evaluation, and into and through manufacturing. These teams may be composed of individuals from engineering and development, marketing and manufacturing, and finance and accounting. The members, as a group, are expected to perform cross-functionally, despite their retained allegiance to their home function. The assumptions that they can and will do this may be naive because some of the decisions and conduct required for team or cross-functional success are antithetical to the home function or its agenda.

In an action sense, for instance, the members are asked to simultaneously perform engineering development work, complete marketing and cost feasibility studies, and conduct an ongoing manufacturing evaluation. They are counseled to do this by negating or ignoring functional activities or responsibilities. Successful accomplishment, in this case, may demand actions and conduct counter to existing procedures and accepted organizational conduct.

Dependence upon a team, even under the direction of a senior person, denotes radical departure from the usual relay analogy for product development within United States' firms, with their formal functional structure. These publicly praised ad hoc team structures and their accompanying successes are symptomatic. It is an indication of the strength of the criticality of the need that these teams have been put in place. That many organizations have not been transformed radically or permanently may be an expression of a lack of knowledge as to source and content of the need. The long-run successes of these specialized endeavors in the face of an unchanged organization must be questioned; the underlying issues have not been addressed.

The ability to successfully complete one or two of these heroic endeavors is one thing; to replicate these outcomes utilizing the basic organization over time and across leadership and other personnel changes is a more fundamental matter. The teams, for example, are often told to get the job done; break rules if necessary. The stress placed on the organization cannot be necessarily positive; responsibilities of functional entities are unclear and individual boundaries are uncertain. Without fundamental change, the organization as a larger entity will respond; it will develop more resilient ways to fend off such momentous challenges and it will become more robust and hardened against non-organization movements.

Teams with their multidisciplinary membership and their delegated cross-functional responsibility and authority hint at the systems management that is required. What is lacking is found in the possible speciality of the team event and its outcomes, in the definition of what is required from the organization in the long run, and what would be required to institutionalize these activities. What will become legal and accepted organizational behavior and response is unanswered by the formation, management, and conduct of these teams and what these teams are to do may be clear and certain in a given case; what is not so clear is why these teams are needed. Over time, as these experiences are recorded, analyzed, and discussed, a larger and deeper understanding will undoubtedly emerge.

Summary

Several issues have been directly addressed in this discussion. There is the need for businesses to focus their vision upon the customer and what is increasingly valued. That vision will require that the organization be restructured around cross-functional systems which deliver the required products and services. Management must accept the responsibility for building and rebuilding these organizational systems, some of which will require unanticipated changes in the current functional format. These are large and momentous requests. The hidden ones may even be larger. Management will have to accept the responsibility for improving relationships and activities between the managers and the nonmanagers. The simplistic view that organizations exist to make a profit will have to be intelligently and realistically faced by understanding and teaching that the organization has customers other than those individuals and groups which make up today's stockholders.

Companies and governments are compelled to respond to the new competitive imperative. Management, labor, and government will be tempted to seek political solutions by resorting to manipulation of trade and financial barriers and nationalistic sensibilities. That type of activity, however, will waste time and energy, and, by disguising and concealing the need for fundamental change, lead to larger hardship, surely for their own people as well as others. The short-term and long-term economic health of the nation, like that of its individual firms, will depend on the will and ability of its people to respond to this new need of attending to the creation of valued products and services. The required changes are massive and ongoing, affecting the roles and responsibilities of nonmanagers and managers alike in terms of expectations, conduct and relationships. For an individual firm, it is particularly crucial that managers at the highest organizational levels personally engage in the changes that are required. ■

CONTINUAL IMPROVEMENT: A PARADIGM FOR ORGANIZATIONAL EFFECTIVENESS

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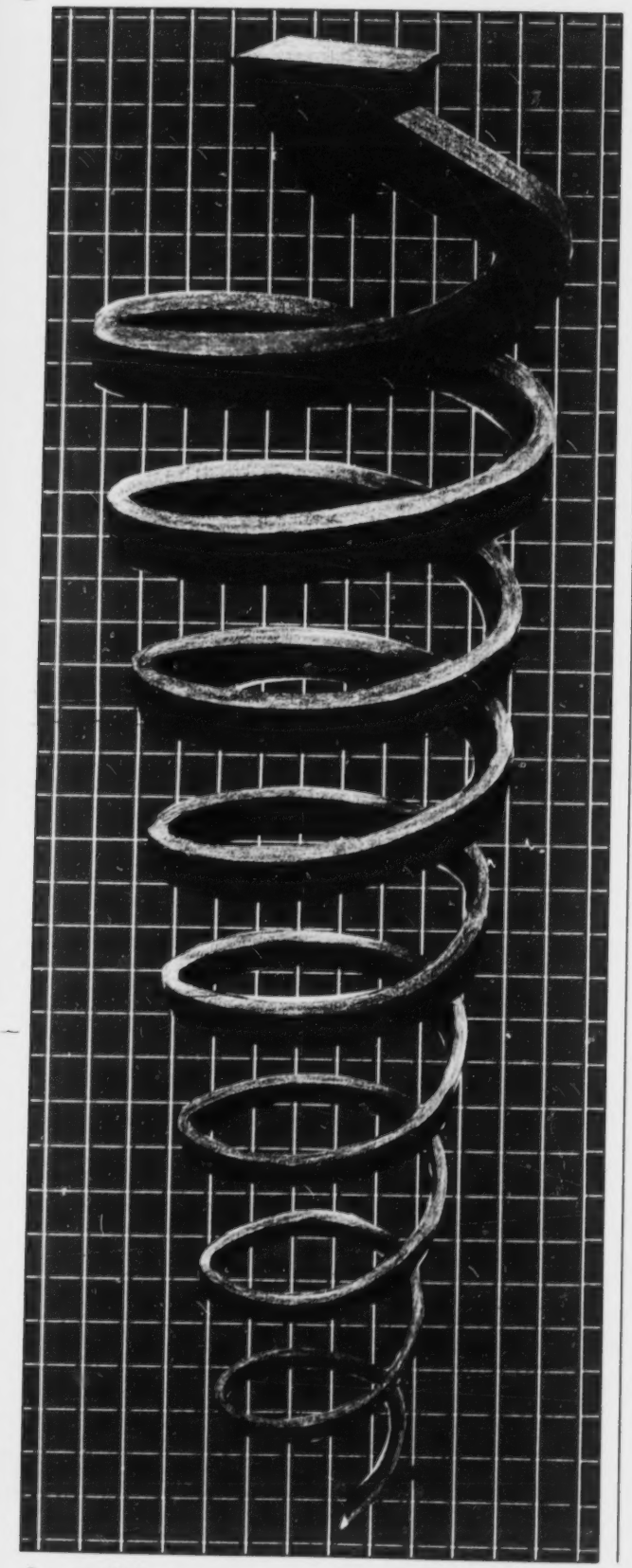
Improvement has long been a vital element as either a goal or as a strategic or tactical element in the management of business enterprises in the United States. Industrial, commercial, and financial firms have undertaken improvement efforts focused on similar themes: to increase productivity, to cut costs, to improve products, and to increase organizational efficiency. Intensive efforts have been devoted to the advancement of manufacturing, delivery and service processes. Scientific and engineering progress contributed to providing material comforts for large numbers of people, surpluses for future development, and a model for production and delivery of goods and services which has been emulated by people throughout the world.

Business firms have long recognized innovation in products, methods, and processes as essential for survival and growth. Manufacturing organizations in the United States have taken pride in leading technological changes in products and processes, and the past record of innovation has supported that pride and confidence.

Evidence of a diminished international trade strength and the strategic content of lost trade suggest changes in world economic relationships, many of them unfavorable for the United States. The position of American manufacturers as leaders of innovation also has shown signs of deterioration. So has this country's ability to effectively deliver product innovations to the marketplace. Numerous explanations and theories, each possessing elements of realism, have been offered for the decline in measures of American economic strength.



Some of the more prevalent explanations attribute the unsatisfactory trends to significant wage differences, a deteriorating work ethic, government subsidies, and biased tariff structures. Other interpretations cite misguided U.S. trade policies, efficient and aggressive industrial strategies adopted by foreign governments in collaboration with private companies, and unfavorable exchange rates. These theories and explanations are important because society works on the perceived problem. If the perception is erroneous or incomplete, then any solution, however successfully implemented, will provide unsatisfactory outcomes and may contribute to further deterioration.

It is important to note that the focus of attention in examining the decline in international trade strength has been on results of competitors' methods, rather than on the methods themselves. Companies competing in markets susceptible to low-wage advantages were the first to become aware of a different strategy being put into place by their competitors; wage advantages were spelled out in terms of lower prices. Domestic companies saw themselves as losing markets because of lower prices and initiated traditional efforts to cut costs. Higher quality combined with competitive pricing was observed as another result. Scale-based strategies dependent upon capital investment for improvements in factor productivity, such as focused factories with few product lines, were employed in the West to counter the price/quality combination. But another wave of results has come from competitors using flexible manufacturing strategies resulting in an increasing ability to innovate products and production. Although the proliferation of products offered by competitors has been recognized, these results have not been connected to the execution of certain basic fundamentals which must be in place to effectively practice a flexible manufacturing strategy.

Negative Trends

Negative trends in international trade strength reflect a low rate of improvement in productivity, insufficient product and process innovation, and an inability to consistently and economically deliver products of uniformly high quality to the marketplace. Market share has been lost, and as a result, the economic base required to support innovation has been eroded. One explanation we would advance for the weak economic results is that improvement work, in kind and quantity, is insufficient to maintain or improve the existing market position. That explanation leads to the proposition that, although the management paradigm of the past half century has been remarkably robust through an era of dramatic scientific and social change, the means for achieving gains prescribed by accepted management theories cannot provide the required levels of improvement. Therefore, one explanation for unfavorable economic trends is that the traditional management paradigm practiced in United States firms has become outdated.

Examination of some customary practices relative to productivity and cost, frequently selected targets of improvement work, provides examples of the inadequacy of traditional practices and

theories. Productivity, defined as output relative to input, has been the focus of improvement initiatives and the subject of numerous comparisons and theories on competitiveness. The assumed leverage to be gained by these efforts is a decrease in the direct labor component of a unit of output, thereby decreasing the effect of the labor cost difference between the U.S. and newly industrialized nations. Methods for achieving productivity goals have included work to improve equipment efficiencies, revamp materials flow, automate processes, simplify work, and reduce waste. The effort has been primarily concentrated upon manufacturing. The net effect of this work is mixed; the larger the fraction of cost attributable to direct labor, the more satisfactory have been results from this approach. In cases where direct labor as a percentage of total inputs has declined over time, continued efforts of this type have provided only marginal benefits. Programs for achieving productivity gains have rarely extended over a period of years, although the daily pressures for schedule and efficiency have continued. The daily focus has been on results and not on the means of achieving them.

Along with productivity, achieving cost reductions has been a parallel improvement goal. Cost cutting to maintain margins in the face of declining prices has long served both as an improvement method and a required result, with the goal typically expressed as a percentage reduction in costs. Unfortunately, some of the tactics employed in efforts to cut costs to remain price competitive have been unwise and short-sighted. In manufacturing, methods by which cost objectives have been achieved include: removing engineering resources from the factory floor, thereby removing the ability to do other than live with the failures and inefficiencies designed into processes; reducing maintenance resources, insuring the existence of equipment-related quality problems and contributing to reduced reliability and durability of equipment; decreasing investment in employee training and development, insuring that the work force cannot improve its ability to operate existing processes and will not be able to cope with advances in technology; and curtailing investment in research and development, thus insuring future market, cost, and productivity vulnerability.

Delaying expenditures for resources critical to long-term performance has gotten managers through the day, and in some cases, the decade. However, some managers have recognized that the effects of resource impoverishment will show up at a later time, disconnected from the actions which produced them, and that the next manager of the unit will have to cope with those effects. Alternatively, mobility of managers within and between organizations may have meant that managers have not observed directly the long-term effects of the measures they adopt as short-term solutions. As a result, they may continue on in the belief that their actions were beneficial and may spread similar actions, and their long-term effects, through the succession of business units they manage.

A myopic concentration upon productivity and direct costs as method and objective, without thought of future consequences, can do nothing but contribute to future problems. Experimentation and innovation are set aside because it is understood that these efforts are likely to result in a short-term decline in output and an increase in costs, both resulting in unsatisfactory performance evaluations for the current period. Consequently, better product quality, shorter lead times, predictable delivery schedules, and improved customer service do not become critical focal points for work. Concentration on direct cost may also mean that indirect labor and burden from numerous sources are not investigated. Management may overlook the importance of overhead in achieving an improved cost position, perhaps because existing accounting systems do not provide information useful for identifying the characteristics and sources of the overhead.

Addressing Productivity and Cost Through Quality

Although productivity and cost have been identified as targets of opportunity in the United States, they seldom have been addressed through quality. Historically, higher quality levels have been associated with higher costs and lower productivity because of the methods used to achieve higher quality: inspect, sort, scrap, rework, downgrade, blend, and so on. Improved quality has been equated with increased inspection, coupled with tighter specifications, and obviously, adding more of the same would further increase costs. The apparent costs of such activities are easily identifiable, due to the existence of a Quality Assurance or Quality Control department with a budget separate from manufacturing. Much of the real cost of waste and complexity introduced by the production of poor quality is not apparent since it is imbedded in manufacturing and other budgets. By narrowly confining the role of quality to an inspection function, the gains to be made by systematically working to discover and eliminate causes of poor quality as a method for reducing costs and improving efficiency and productivity have not been extensively explored. In addition, the benefits from improving the functions which design and produce the product, along with those which support and service those activities, have gone unrecognized.

The interpretation of quality as conformance to specifications has been detrimental to achieving improved productivity and reduced cost by quality improvement. The establishment of specifications on a product or service demonstrates a tacit understanding that measured characteristics will vary from one item to the next and that large amounts of variation cannot be tolerated. Historically, specifications or tolerances appear to have been intended as boundaries within which a product or component could be expected to function or be assembled. Over time, specifications have taken on the interpretation of defining the best that should be expected; i.e., defining quality and nonquality on a discontinuous scale. Material having measurements within specifications was assumed to be as good as any other material also within specifications; variation within specifications was not recognized as being important and was ignored. The local, downstream, and external costs of that unobserved variation, in unsatisfactory product and material use, were not appreciated. Consequently, opportunities to gain

process knowledge and improvement of quality through study of variation went unexplored.

An additional contributor to making quality a low-priority item has been a definition of quality restricted to the product or service entering the external marketplace. Quality has not been defined in terms of product design, or with respect to accounting, financial, marketing or other staff functions. Quality for these functions should be seen relative to how well the activities of the function are performed, in addition to their impact on product quality or customer service. Product design as a function and an output affects costs in several ways. Design cycle time, design standardization, replication ease in manufacturing, performance relative to market expectations, and field reliability are all important factors in determining various costs. Product designs can be complicated needlessly, affecting quality levels and adding to complexity in manufacture or assembly, all adding to costs. Product design affects defect levels which affect material use, cycle times, inventories, material and labor costs. Further, the design function experiences its own cost inflation resulting from the need to correct or rework design flaws.

There are other costs related to quality levels: warranty, field repair and customer service, ill-will, and others which remain unknown. Many of these costs are routinely underestimated and in some instances are not estimable. For this reason, classical cost-benefit analysis may not provide useful guidelines for selecting improvement opportunities or for setting the intensity and duration of the work done in preventing or reducing quality problems. Where quality is erratic or low, planning and budgeting process are weakened, ability to meet delivery schedules is unreliable, and plant inefficiencies are multiplied by periodic downgrades which cascade into production scheduling and other activities.

Once it is understood that improved quality serves corporate improvement goals in a broad sense, through reduction of cost and improved productivity, the perceived impact of quality is expanded. Quality levels are an important determinant of material, labor, and overhead costs. Quality levels fix yield, directly affecting labor costs. By fixing the amount of throughput, yields affect overhead, determine material usage, and influence machine time and labor. Unpredictable, erratic yields affect inventories of raw material, components and finished goods, all of those being larger than otherwise needed in order to offset the resources used to manufacture unacceptable product. Defect levels also affect laboratory, equipment, space and administrative requirements. Numerous additional record keeping requirements are imposed by the need to determine the quality of materials and dispose of them accordingly, adding a costly burden of complexity to the system.

Features of Past Improvement Practices

In the West, improvement has not been a systematic and continual activity nor has it been recognized as a method as well as a result. Improvement work has typically been a sporadic undertaking characterized by very intense efforts during periods of externally induced crisis or during budget formulation and review periods. Improved output, productivity, and cost position typically have been attained at widespread, discrete points in time. This approach, which relies heavily upon capital expenditures and innovation, is an identifiable component of Western management strategy and style. Periodic projects, perhaps annual or biannual, to improve processes or competitive position were accepted practices and indicative of good business planning. Older facilities might be improved through major rebuilds or innovations. New factories containing the latest in process technology would be built periodically. New or innovated products were released on a model year basis. Installment of new technology has been relied upon to solve quality and productivity problems. Although some industries and individual firms have suffered from inadequate capital replacement resulting from short-term decisions, there are numerous examples of periodic upgrading of products and processes.

Improvement work typically has not been identified as a stated objective in corporate strategy beyond the usually stated goals of reducing costs or inventories or increasing productivity. If the objective of the work is to continually improve business systems and processes for the purpose of remaining viable as a business enterprise, it is crucial that the objective be spelled out and convincingly articulated. If the rationale for improvement and its larger purpose are not discussed and explained well, demand for improvement will be interpreted in a historical context and practiced accordingly. If reduction in cost is mentioned as an objective, the usual cost-cutting approaches will be applied unless considerable care is taken to reinterpret the language and objective in a new context and to delineate the new methodology to be used to reach the objective.

A New Paradigm for Improvement

Improvement as an objective is neither startlingly new nor different. The change lies in the context, method, and rationale for improvement. Toyota and other Japanese companies pioneering in continual improvement adopted the view that any process could be further improved in the near and intermediate term. Because processes were not expected to be static, machinery, people, methods, and relationships among them had to be flexible. It was expected that all processes would be continually improved throughout any time period. These ideas heavily influenced planning for process design and equipment purchases, putting a premium on flexibility. Some results of that improvement work, now widely recognized as manufacturing innovations, included development of the "pull" system, just-in-time inventory, rapid setup, and flexible machinery and lines. Operators were highly trained and versatile. Management built suppliers into the improvement process.

Further refinement has emphasized the idea that quality, productivity, delivery, and cost are end results, generated by the systems which compose the business enterprise. Measures of quality, productivity, delivery and cost serve only as meters

reflecting the organization's performance; the size, variation, and rate of change in these numbers reflect how well management is doing its job. Improvement activity is focused upon the means by which these and other characteristics are determined. Cost, quality or delivery are characteristics which are not worked upon directly. Rather, the focus is upon the causes of those outcomes. Obviously, there are numerous causes, differing in their effect upon quality, schedule, and cost; the intelligent selection of causes and the work on those causes affords consistency and longevity to the enterprise and benefits to customers, employees and stockholders.

Continual improvement implies continuous positive change. Sustained improvement work results in a sequence of incremental gains in performance of a process, by whatever criteria performance might be defined, followed by actions to standardize at the new level of performance. Interpretation of what constitutes improvement varies. A reduced level of recognized problems to be fixed, reduced variation in a measured characteristic, reduced downtime, increased quantity of good output produced per hour, reduced frequency of customer complaints, reduced complexity, quicker response time; all of the preceding and more can be seen as indicators of improvement.

Processes and the System

Continual improvement requires recognition that work is a process and that appropriate action for sustained improvement comes as a result of developing process knowledge. The common elements of work carried out over time are often not recognized as repeated transactions of a process, yet few organizational transactions are unique, one-time events. Instead, each transaction is part of a sequence of similar kinds of activities. Such a sequence may be seen as a process. A process can be defined quite simply as a collection of actions which produces an end result. The end result may be a physical item (a component, a batch of material, an assembly), it may be a piece of information (an invoice, a schedule, an authorization) or a design, or it may be new knowledge gained (the result of an educational process) or a chosen course of action (the result of a decision process).

Repetitions of common process elements lead to the development of experience and professional expertise. An engineer who designs parts carries out, with each new part, a sequence of activities which are common to the process of designing parts. The intended function is translated to the design, a plan for testing is developed and carried out, tolerances are developed, part prints and raw materials specifications are produced. Although each part is new, the activities carried out to develop the part from initial concept to production are not. A buyer of machines buys a new machine each time, but repeats the same kinds of activities for each purchase. Training, hiring, budgeting, accounting, forecasting, purchasing, supervising, selling, scheduling, ...; all are activities which include a number of processes. All of these processes are subject to study and improvement. Each process can be examined for satisfaction of the customer's (recipient's) needs with no need for rework and screening to weed out mistakes and for elimination of waste in the form of complexity and non-value-added activity.

The work of an organization is carried out within the confines of the larger organizational system. Organizational structure, principles, policies and practices, communications, planning, and resource allocation create the environment within which work is done and govern the quality and efficiency of inter-unit and inter-functional transactions as well as the activities going on within work units and functions. Quality problems arising from individual processes most often have their roots in the larger system. For example, quality problems related to incoming supplies may be traced to a de facto purchasing policy of minimizing purchase price without regard for quality and cost of use. The practice of such a policy is driven by an evaluation and reward system which stresses minimizing within-unit or within-function costs regardless of total cost to the organization. The magnitude of improvement which can be made in an organization depends upon the level at which change takes place: the higher, the greater.

A Cycle of Continual Improvement

A continual process of study, experimentation, development of knowledge and action to create improvement was described by W. Edwards Deming to the Japanese in 1950 and attributed by Deming to Walter Shewhart. The Japanese have popularized the cycle as P-D-C-A (Plan, Do, Check, Act). Deming has emphasized that the cycle should be described as Plan, Do, Study, Act. The aim of the third step in the cycle should be to develop understanding and knowledge of the causes which generate outcomes of a process by statistical study of those outcomes, process characteristics, and the results of pilot studies and experiments. The lack of an ending point implies no limit or boundary to the practice of the cycle or to the degree of improvement which can be achieved by continual repetition.

A cycle of investigation, learning, and organizational change is difficult to reduce to an algorithm and perhaps should not be. However, we will present one version of a sequence of steps which could be carried out to practice the cycle, recognizing that it is but a limited attempt to describe a complex process. The sequence described below is necessarily linear; the process of improvement is not.

1. Identify an opportunity for improvement and the process to be improved.
2. Gather the key players.
3. Identify the purpose of the process.
4. Describe the existing process, including activities, decisions, customers, suppliers.
5. Study the existing process. Make obvious improvements.

6. Develop theories on cause and effect.
7. Plan sampling studies, experiments or pilot studies to investigate causes.
8. Conduct studies.
9. Analyze the results and propose actions.
10. Adopt proposed actions and standardize (institutionalize).
11. Examine for system implications to be addressed at the proper managerial level.
12. Return to 2, 3, 4 or 5 and repeat.

A manager, even at the highest levels of an organization, should understand the methodological approach to improvement described above. As participant in improvement of systems, the manager should practice such a cycle. Further, the manager as leader of those who are working on operational improvements should understand the methodology in order to lead it and to ask questions of subordinates which probe their methodological practices for depth and potential to sustain improvement.

In manufacturing, potential areas for improvement can often be identified by use of existing data in the form of customer complaints, warranty claims, or inspection data on nonconformities, rework and scrap. However, many quality and productivity problems are not reported in a typical inspection system. Errors, omissions, and other difficulties with purchase requisitions, accounting and financial records, production schedules, engineering output, maintenance and other activities are not usually noted, recorded, or analyzed for their impact on quality, productivity and cost. In nonproduction cases, quality levels can be determined and studied by methodology similar to that used in production.

Quality problems related to management processes are not revealed by relying upon typical data sets except in indirect terms of organization-wide results. But it is among management systems, difficult to define and characterize, and often ownerless, that much opportunity for improvement will be found. Perceived problems related to general systems can be turned up by actively surveying employees at all levels. However, problems with management systems will be revealed more often as a result of formal effort by management teams to identify and analyze these systems for barriers to improvement.

Although thought should be given to selecting a promising area for improvement, the selection should not become an end in itself. It is likely that there is no best process or system to select for improvement. There have been cases in which inability to select the best place to start has been used as a means of avoiding any work for improvement. The important thing is to select a process and begin the work. All those involved in the improvement work either directly or indirectly, should understand that results achieved are dependent upon a number of factors related to the personnel involved, the environmental circumstances, the organizational culture, the difficulty of the problems to be solved, and the degree of managerial support and participation; therefore, the degree and time of accomplishment cannot be guaranteed.

A key step in planning for improvement is to identify the personnel who will contribute to the improvement work. Although all of the people identified may not participate at the same level of intensity, it is important to identify the expertise needed for the work and the managers whose action will be required to effect system changes. Although people at lower levels may have the ability to make local improvements, it is also necessary to obtain the support and participation of managers who can effect system changes so that improvement is sustained.

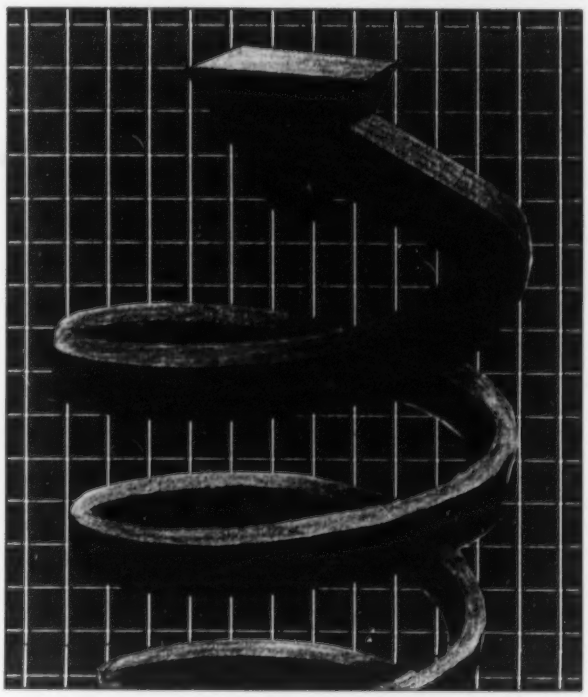
A process operates through time, producing a stream of product or end results. Almost surely, numerical records of outcomes from a process will exhibit variation when they are examined as a sequence over time. Knowledge of variation in process outcomes is crucial to effective improvement. The magnitude and pattern of that variation provides a commentary on the behavior of the process in terms of the results it is producing and on the causes which are acting to produce the results.

The term statistical control refers to the magnitude and pattern of the variation observed. A process in statistical control will produce variation only of a certain magnitude and the results will remain at a steady level with no detectable systematic patterns. The limits of variation (control limits) for a process in statistical control are derived from process data, not from specifications or from the desires of an individual or group. Conceptually, a process in statistical control could be described as steady, unwavering, producing results at the same level, with variation of a predictable magnitude. A process in a state of control has variation produced by a collection of causes which are always acting to create the day-to-day, week-to-week, and/or month-to-month fluctuations seen in outcomes. Collectively, these common causes of variation guarantee that today's outcome will be different from yesterday's.

An enlightened manager knows that, when only common causes are acting, attempts to explain differences of outcomes from one time period to the next by identifying a single cause will result in an explanation, but will not identify the source of, or fix, a problem. Demands for explanations and attempts to make corrections on the basis of single outcomes produced by common causes may serve to induce more variation, by leading people to take actions on symptoms rather than causes. The enlightened manager also knows that a process not in a state of statistical control is influenced by special, intermittent causes, as well as common causes, and therefore produces unpredictable variation. Unpredictable variation destroys the ability to plan and manage effectively. It is important for the manager to know the state of statistical control of a process and to take actions appropriate to the situation.

As the study of an existing process proceeds, a variety of ideas on process improvement will be generated. Some of these ideas will entail working on obvious problems. However, work to improve, not just maintain, the quality level of a process must necessarily go past the level of simply reacting to existing problems, maintaining a certain quality level, or returning a process to its original intent. In a hierarchy of activities which might be described as addressing existing problems and future performance, continual improvement ranks high because of the level of analytic thought, as well as the level of management leadership required. Such a hierarchy might be described as follows:

Problem solving in the "band-aid" sense. Actions are taken to respond to a current complaint or problem with the intent of keeping an operation or process functioning throughout the day or week. Without appropriate guidance from upper management, work to identify ways of improving a process often does not proceed beyond this type of reactive problem-solving.



Problem solving in the maintenance sense. Adjustments are made and other actions are taken to maintain what is considered to be an acceptable level of failure or variation. Maintenance is sometimes put forth as the sole objective of "SPC," statistical process control. Some writers encourage that view by describing a situation in which the operator plots points on a control chart and adjusts his machine or process when an out-of-control point occurs. This is a limited and limiting interpretation of the use of control charts to aid in the study of ongoing processes, both by implying that study of variation should be confined to the production floor and by implying that minimal improvement can be made to existing processes.

Problem solving in the preventive sense. Actions are taken to "assure" that a problem will not recur. Some so-called preventive "solutions" consist of implementing 100 percent screening to prevent a problem from getting further downstream. These make-inspect "solutions" are often put into place without determining whether the problem is sporadic or chronic, attempting to identify and act on the cause, or considering the costs of implementing and continuing screening at a particular stage. Preventive problem-solving should consist of identifying and removing the source of a recognized problem, a potentially cost-effective action for improvement.

Continual improvement. Systematic work is done to gain sustained operational improvement. Gains are achieved with little capital investment. Work procedures are reviewed for improvement; efforts are made to identify and reduce complexity. Methods are continually reviewed to find possibilities for improvement. Innovation takes place at the local level. At the functional and business unit level, customers for the work done by the function are identified, their needs are identified, the gap between the customer's needs and the current ability to meet those needs is seriously addressed. Policies and practices are reviewed to identify barriers to improvement.

Innovation. Fundamental changes are made to process or product design; new processes and products are created. The magnitude of the gain in improvement is dramatic. Innovation has strong appeal for North Americans; the culture recognizes, approves and rewards invention. There appears to be a strong tendency to appeal to and wait for innovation to step in and rescue the organization from the chronic problems of existing systems and processes. There is a strong belief that technology, or simply something new, can replace an inability to make existing methods work. This reliance on the new and untried appears to exist at all levels of organizations. Without systematic attempts to improve management practice, in the absence of improved training and education, without the ability to stabilize and standardize existing processes, without an understanding of quality and of variation, it is likely that the anticipated benefits of innovation cannot be maintained, if they are achieved.

The first three items in the preceding hierarchy are directed toward returning a process and its product to their original intent and maintaining that intent. These kinds of activities are usually driven by the existence of a perceived problem: current data show nonconformance, customers are complaining, overtime is excessive, and so on. Improvement work generated by feedback in the form of perceived problems might be termed reactive. When an organization's improvement in results levels off and stalls out, a partial explanation may be that improvement work has been primarily reactive in nature; improvements have not been made to the organizational system. The adoption of continual improvement as organizational policy and practice implies that improvement activity will eventually evolve to work on processes and systems which are generating no feedback in the form of urgent and easily recognizable problems. Improvement work without perceived problems as generators might be termed proactive. Conscious effort and discipline is required to practice proactive improvement. Continual

refinement, simplification and reduction of variation do not carry the glamour associated with heroic problem-solving. The gains from continual improvement are often imperceptible over the short term. A reward system which values short-term visible results creates a strong pressure against proactive improvement. In the early stages of organizational focus on quality, it is not likely that management will promote and support work on "problem-free" processes, particularly when the decision for change comes about as a result of current or impending crisis. Given the current state of education and thought in North American businesses, it may be that continual improvement is a second phase in an evolutionary process, necessarily preceded by work devoted to fixing existing problems.

Management's Role

Without knowledge and understanding of the need for and methods of systems improvement, it is quite probable that improvement work will be restricted to activities at the operations level. When management does not understand its role in developing improvement strategies, setting priorities, and providing opportunities and resources for improvement, and when it has a need to demonstrate that some activity is taking place, it is almost inevitable that improvement work will be pushed toward lower levels of the organization. At the operations level, processes which provide services or produce manufactured parts or tooling will be improved somewhat by problem-solving activity. However, a limit on improvement is imposed by the design of the process and by barriers put in place by the policies and practices of the organizational system. Results achieved at low levels can be very good and still be incomplete because of the inability, through lack of action at higher levels, to create process or system changes to remove root causes and institutionalize improvements.

There are other difficulties associated with attempting to generate and sustain improvement without direction and personal involvement by management. Supervisors and technical personnel are uncertain about which activities to undertake and how much time and resources to devote to improvement versus ongoing operational activities. Authority to devote significant amounts of time, obtain appropriate technical support and summon other resources is lacking at low levels of an organization. Further, use by management of a system of reward based on visible unit-specific results, such as production volumes or operating costs, creates internal competition and sends an anti-improvement, short-term message to personnel at lower levels. When work on productivity and quality is pushed to the lower levels, it is focused on fixing problems which are but fallout from defective and disruptive management systems.

The attention of management groups should be focused on defining, measuring and understanding various management systems to determine how problems are created by those systems and placed into the work environment. As management groups identify systemic deficiencies, groups should be trained and put to work to clear up near-term problems while higher management works on system improvements that would eliminate the occurrence of those problems in the future. At the systems level, there is near-term work to be done to correct the current system for its error-inducing effects while long-term work is done to gain a better understanding of how processes and systems function and undesirable outcomes are produced.

Management should be planning at a conceptual level and anticipating and preventing weaknesses before they get imbedded in the activities of the organization. Management, as a part of their responsibility, must begin to plan for formal improvement activity and to impress upon their subordinates through feedback and coaching that serious work to improve processes and systems is highly valued. As management persons become involved in finding and identifying opportunities for improvement, the roles of passive administrator and distant strategist are vacated and one of active participant is assumed. Management must work on those systems which have produced existing operational problems and must initiate special investigations into product design problems, purchasing policies, marketing and selling strategies, reward systems, and other systems with the objective of removing the barriers to improvement at all levels.

The Continually Improving Organization

Continual improvement by working on systems or processes differs from older, more accepted practices in several respects. The intermittent timing of the more traditional work is taken to be inadequate. It is not sufficient to have an organization improve itself by responding to a crisis regarding a product, product change, cost or distribution structure, or in other respects. It is not sufficient to rely on annual changes in equipment, procedures or products to provide the wherewithal to meet improvement necessities. Continual improvement is to be the living embodiment of a strategic recognition that change is too important to wait for crisis or to be had on an annual basis, although those are surely important and both will continue. Larger rates of improvement are necessary and work to improve operations, processes, and systems must continually be done, with incremental changes occurring systematically throughout the year.

The horizon of opportunity expands as the organization begins to examine its processes and systems. There is a focus on managing upstream processes; product design and procurement become targets of opportunity. Suppliers are enlisted as collaborators in the improvement effort. Customer evaluations become information points; marketing and product design become linked. Sales and logistics are examined for value added tasks, as are financial and accounting functions. But the view of and needs for continual improvement are even more comprehensive. Organizational systems are to be recognized for what they are, systems which either facilitate or restrain the behaviors and resource flows which feed, support, and drive the change. Organizations which continue to live by functional areas of responsibility, authority, and operations will be handicapped in this different era. Newer organizations will be flatter and more horizontal, with fewer layers of management. Staff areas will be

leaner, with a strong emphasis on service. The more effective organizations will be those which can more successfully manage the gaps between functions and create correct alignment within and across functions. What is required may be described more accurately as cross-functional system management.

Continual improvement itself is a result as well as a method. All past practices should not be thrown out. Management must get much of the work done through others. However, management must assume responsibility for the work. The principles of scientific management can still be applied to the study, revision, and standardization of work practices. Mechanization of work processes will continue. A corporate hierarchy will remain; indeed it is required. However, the content of activities at all levels of the hierarchy will change. The role of leadership is vital. Management must assume responsibility for characterizing or describing systems, defining parameters or appropriate performance measures, identifying causes, and for improving those systems over time. This work requires a different relationship with one's supervisor, peers, and subordinates than does the traditional management culture. Cooperation and coordination become valued characteristics in performing work.

It is important not to confuse the results of continual improvement with the work to obtain improvement. A flexible manufacturing strategy with the ability to respond rapidly to market changes and to support and encourage expanding varieties of products and services is based upon an increased ability to innovate in design, manufacturing, and service support. Innovation is supported by economic strength and the ability to plan and execute. These are results of work to stabilize and improve processes and systems.

At a minimum, an organization must have the vitality to insure that it will not be left behind as improvement is spelled out in different and unknown ways in the future. Ideally, the organization will have the leadership, people and systems to be leading those waves of future changes. The means by which those changes are to be realized are vitally important to understand and develop.

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REFORMING THE MANUFACTURING ORGANIZATION

by Robert W. Hall

Companies which make the all-American list for acclaimed manufacturing improvement have thrusts in three areas. First, and most important, these companies are developing their employees to perform more effectively both as individuals and as team members. Intensive training in skills and changing organizational structure not only create better manufacturing ability, but foster a better spirit for continuous improvement. Second, these companies promote quality throughout all of their operations; and third, they revolutionize their processes--layouts, material flows, systems, and management of suppliers.

To sustain improvement, the companies employ broad-based goals; the objective is not to merely "install SPC" to keep statistical charts or to revise material flow for a one-time reduction in inventory, but to make the changes necessary to actually improve quality.

The better processes of improvement are guided by broad goals: to increase both internal and external quality; to drastically reduce lead times of many activities -- not just lead times of material going through a plant; to increase the skill and morale of the human capital of the company; to eliminate waste -- unnecessary activity; and perhaps the most overriding goal is to increase the satisfaction of the customer.

"Motherhood" goals provide only temporary inspiration if they are unaccompanied by specific actions. Many of the more successful companies simply started changing layouts or instituted employee improvement activities,

all with a minimum of philosophizing about it at first.

Changes in techniques can be made with a minimum of concern for management mindsets. Numerous managers conceive of Statistical Process Control (SPC), Total Quality Control (TQC), or Just in Time (JIT) as just a set of techniques, so implementation is a program which follows a checklist. While much can be accomplished that way, managers soon begin to find that roadblocks to continued success are the mindsets of people, their organization, and their responsibilities. There is a difference between *leadership* of an ongoing improvement process and management of a program or a series of projects.

A plant layout can be changed by drawing up a schedule and directing work crews through the schedule. A work force can be trained in the seven old tools of quality control by drawing up and executing a training schedule. Whether the training is effective in substantially reducing defects is another issue. Companies soon find that adopting new techniques is of limited benefit without also converting the minds and hearts of managers and workers. A reform movement is necessary.

The Association for Manufacturing Excellence conducts workshops at which a host company invites personnel from other companies to come and see the results of their improvement process. Quality, a JIT system, supplier management, or similar topics are frequently the featured themes of these workshops. However, the most popular themes deal with changes in organization and in the mindsets of people. Even the workshops with other themes frequently have the workshop discussion drift into issues of organizational change. Development of people and organization was considered to be either the planned or unplanned central focus at 18 out of 20 recent workshops.

The reason for concentrating on people development themes is that success is limited without it. For example, a layout change which allows material to flow quickly from machine to machine can obviously make great improvements in throughput time, compared to one in which material moves between departments to go to the next machine. However, the social system and the organizational structure of the factory are disrupted when the layout is changed. If managers want workers to seriously engage in quality problem solving, the workers need to be empowered to make suggestions that will actually be implemented if they are good. Worker involvement demands a huge amount of time from the managers who coordinate it and respond to it.

Companies that have managed their human resources well -- prepared both workers and managers for different roles --seem to do better. If a company makes an error in layout, quality procedure, or setup methodology (i.e., technique) the errors are not very difficult to resolve. However, errors that create mistrust among different factions of people take more effort to resolve. Organizations that have trouble implementing the new thinking fail to recognize that the limit to the rate of change is the speed with which people can adapt to a new philosophy.

Modifying Mindsets

The potential for conflict between old and new thinking is always present, as can be seen in Figure 1. The changes in thinking penetrate to "gut level" issues in most companies. Techniques can be learned more quickly than can a basic shift in manufacturing philosophy.

Three years ago, a study comparison was made between pairs of companies in each of three industries.[1] One member of each pair was in Japan; the other, in the United States. One of the observations was subjective -- a comparison of managerial thinking about JIT/TQC. The Japanese recognized that the implementation began with a fundamental change in their own perspective and attitudes. The American understanding reflected the learning of new techniques, so Americans tried to graft new business techniques onto an old philosophy of business and its goals.

One symptom of this crossover is the use of cost-of-quality calculations. Most existing accounting systems do not have chart headings in categories which easily correspond to subtle effects of quality problems. Aside from chart headings for scrap and for direct labor rework, few systems can measure the "hidden" costs of quality errors. For example, no rework category is apt to cover working with the customer to clarify the actual intent of their order if the original order contained an error.

Despite the problems of measuring the cost of quality, this measure remains very popular because it translates an objective which is difficult to understand -- quality -- into objectives which are accepted and easy to understand -- cost reduction and

FIGURE 1
New Vs. Old Paradigms Of Manufacturing Thought

OLD PARADIGM	NEW PARADIGM
1. Economy of *scale* as a basis for improvement logic.	1. Economy of *time* as a basis for improvement logic.
2. Quality is a business trade-off. No decision.	2. Quality is a "religion." No compromise. Better quality should cost less.
3. Doers are separated from thinkers.	3. Doers must also be thinkers.
4. Assets are things.	4. Assets are people.
5. Profit is the #1 business goal.	5. Customer satisfaction is the #1 business goal.
6. Hierarchical organizations. Please the boss.	6. Problem-solving network organizations. Please the (internal or external) customer.
7. Measure to judge operational results.	7. Measure to help people make operational improvements.

1. Jinichiro Nakane and R. W. Hall, "Developing Flexibility for Excellence in Manufacturing" (Dearborn, MI: Arthur Young & Co., Symposium, March 11, 1988).

profit. Were the quality objectives really dominant, much of the need for cost of quality would disappear. Management would learn from experience that decreasing defect rates by removing waste also decreases cost.

Differences in thinking manifest themselves in many ways. One manager became concerned about calculating the "optimal" number of kanbans in his JIT system. However, with JIT philosophy, there is no such thing as an optimal amount of inventory -- which is represented by the number of kanbans in the system. More inventory must occasionally be tolerated so that it can cover problems we do not know how to address; no one familiar with the new paradigm would refer to an inventory level as optimal.

Differences between economy-of-scale (old) thinking and economy-of-time (new) thinking are deep and pervasive. The contradictions lead to much confusion. One of the most common misconceptions is to combine JIT with maximum output objectives. The old paradigm is to run a line at its maximum rate, thereby assuring that there is always a bottleneck to attack somewhere in the line. The new paradigm is to run any process only at the rate needed to serve the market. Only if a line is unable to run at a rate fast enough to satisfy a market would it ever have a bottleneck.

The difference between the paradigms is more subtle. Under the old philosophy, one should always run very nearly at capacity, so as to maximize the return on the capital invested and minimize cost per unit. However, if the chief objective is to satisfy customers, then the incentive when planning capacity is to try to avoid a situation in which capacity is inadequate and to constantly attempt to provide capacity at a minimum cost.

The major difference between the old and new paradigms is in the organization of personnel. The teamwork necessary to attain high levels of performance is not possible in the hierarchical organizations where it was assumed that the workers simply worked and did as they were told. As soon as a process to recognize and solve quality problems begins among the workers, it becomes obvious that the old assumptions must give way to the development of a thinking worker.

Under the old paradigm, operations, departments, and even people were often considered independent from each other. Even the accounting systems assumed that the cost of operations were independent from each other, and a total cost was the sum of the costs of independent operations. This system overlooked the joint nature of the overhead and the purposes for it. The system was blind to the possibilities for better cooperation among operations to reduce overhead.

Relationship Between Quality and Lead Times

Some managers believe that a longer lead time is necessary to do quality work. Occasionally that is true, as in the wine business, but in manufacturing, it is seldom true, because quality work should be done correctly the first time.

Shorter lead times mean quicker feedback time. Less work-in-process inventory means that if a prior operation has been done incorrectly, there is less inventory in the process to rework -- or to throw away. Shorter lead times decrease the concentration of defects in the process.

A behavioral corollary of short lead times is that every operation should have contact with its internal customers. Short lead times allow for prompt feedback of quality problems, whether the problem is with the product being built, or with the process which accompanies it. (For instance, containers which are awkward to handle by the customer are part of the accompanying process.)

The concept of the internal customer is very important both for high quality and for reduced lead times. In a JIT system, one of the best ways to develop personal responsibility for quality is to regard the operations served as internal customers. To provide what is needed by the customer, the operation should define the customer, determine his needs, and establish the operation specifications. The concept of the internal customer, as well as external ones, serves to create the proper attitude toward excellent performance by every individual.

One well-known way to reduce the lead time of material through a production process is to reduce the setup times at all operations in the process. After reduction of setup times, production lot sizes can be reduced, and smaller lot sizes can be produced with less elapsed time. However, there are more reasons for reducing setup times than just to reduce throughput times (and with them, work-in-process inventories).

First, setup times can be reduced by eliminating the wasted time from the setup -- by the company's being prepared as soon as the time for setup arrives. However, much more can be done to reduce setup times. The setup procedure should become standard. The same group of people should repeatedly perform the setup on the same machines. It should not be a learn-from-scratch procedure every time.

Reducing setup times normally has the side effect of improving quality or attaining similar quality at less cost. To improve quality, setups should be practiced regularly. To standardize setup methods, a quality result should be produced on the first try. Any quality measurements should be refined. The ideal scenario is to develop a setup procedure that quickly provides fail-safe quality with every setup, time after time. If setups are to be performed at regular times, i.e., once a week, then the regular practice can be converted into a routine improvement process.

Once the company has rid itself of obvious wastes, it should consider the refurbishment. Besides revisions that allow exchanges of tooling quickly, an allowance should be made for a drastic reduction in adjustment times.

A good product on the first trial requires the following measures:

- Understand exactly what is required for a good part. Quality specifications should be clear. The tooling and equipment should be capable of producing a quality part without special adjustments. Quick setup of a process which is only marginally capable of quality production still needs work.

- Making maintenance of the tooling and equipment a routine procedure. Setup time is not the time to do maintenance work. Preventive maintenance accompanies both lead time reduction and quality improvement.

- Correct initial refurbishment of tools or equipment. Work done between setups needs to be done correctly also, on time, and by a regular pattern.
- Correct calibration of instruments used for measurements during setup.

A production process capable of effecting numerous setups in the course of a single day consequently contributes to the satisfaction of many customers each day. A process running just one big lot size for just one customer all day serves only one customer a day; the rest are kept waiting.

The Reformed Organization

The new organization should be a problem-solving network rather than a set of hierarchies, each laying a claim to a different functional specialty of the sort which most manufacturing companies are organized by. In recent years, many companies have cut the distance from the bottom to the top of the hierarchies by chopping out the layers in the middle. Most large companies have some matrix organizations to short-circuit some of the bureaucratic delays associated with functional organization.

These actions are still not enough to cope with the new paradigm and create the environment it needs. The new organization needs rapid horizontal communication, and it needs a different spirit. One of the most effective ways to create a different feeling among people is through the concept of the internal customer.

The next operation, which suggests that workers are also "customers," does not directly conflict with the hierarchical paradigm until it suggests that a "higher" level person should be a supplier to a "lower" level person. However, if the personnel of a plant accept that one of their major customers is the worker in the factory, an entirely different point of view (and attitude) follows. The same transformation occurs if design engineers understand that they have many customers: end users, repair workers in the field, logistics, production, etc. Their job is not just to produce a technically-elegant design; in fact, almost all the functions within companies have "customers" in the other functions of the company.

More is involved than merely developing a different spirit. The concept of the internal customer stimulates a continuous improvement process. The process of determining how to satisfy a customer's requirement is a variation of the scientific method for defining and solving problems. This approach emphasizes beginning the management process with an assessment of customer needs.

The lead time reductions promised by JIT manufacturing cannot be reached without overcoming the many problems which prevent the smooth, efficient flow of production. The roots of these problems can be found anywhere--from a misunderstanding of an external customer's requirements to the design of a product; on the production floor, or elsewhere. Quality excellence and JIT are a total company activities. They reinforce each other, and neither advances without a network of problem-solving activity developing within the company.

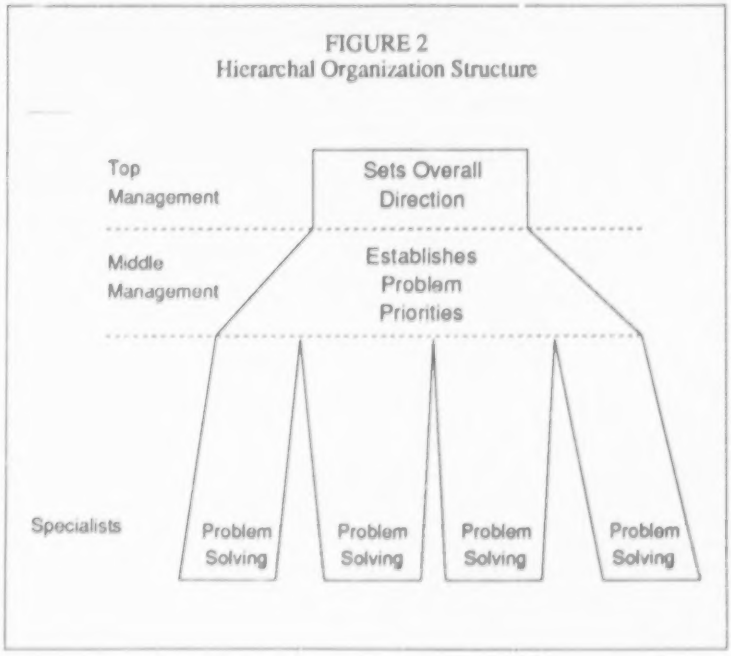
To accomplish its purpose, the new manufacturing organization needs to look like a problem-solving network rather than a traditional hierarchy. Top managers set overall strategic direction; then the organization interacts to determine *how* to execute the strategy. Problem solving is much different in a hierarchy than it is in a network. (See Figures 2 and 3.)

In a hierarchy, the middle managers determine the existence of problems and their priority and assign specialized resources to tackle problems in order of priority. People at the bottom of the hierarchy, unless they happen to be located close to each other -- or carpool together -- do not exchange much information. Sometimes they even have difficulty understanding each other because of differences in technical jargons. In addition, the problem-solving approaches of different technical specialists also differ. An accounting specialist may not see problems that are readily detected by an engineer, and vice versa: they have few common techniques or vocabularies when approaching a problem, even when it is the same problem.

This difficulty is sometimes referred to as "the functional silo syndrome." Tall hierarchies are likened to a set of tall farm silos, all separated from each other by great distances over which communication is very difficult. In fact, the internal competition between silos in some companies is more heated than is the competition with rival companies in the same market.

Two companies which are doing something to overcome the "functional silo syndrome" are Xerox and Goodyear. Xerox has made most of its changes in headquarters and middle management functions; Goodyear has made most of its changes in plant organization.[2]

FIGURE 2
Hierarchal Organization Structure



2. Study Group on Functional Organization of the Association for Manufacturing Excellence, "Organizational Renewal -- Tearing Down the Functional Silos," *Target* (Summer 1988), 4-14.

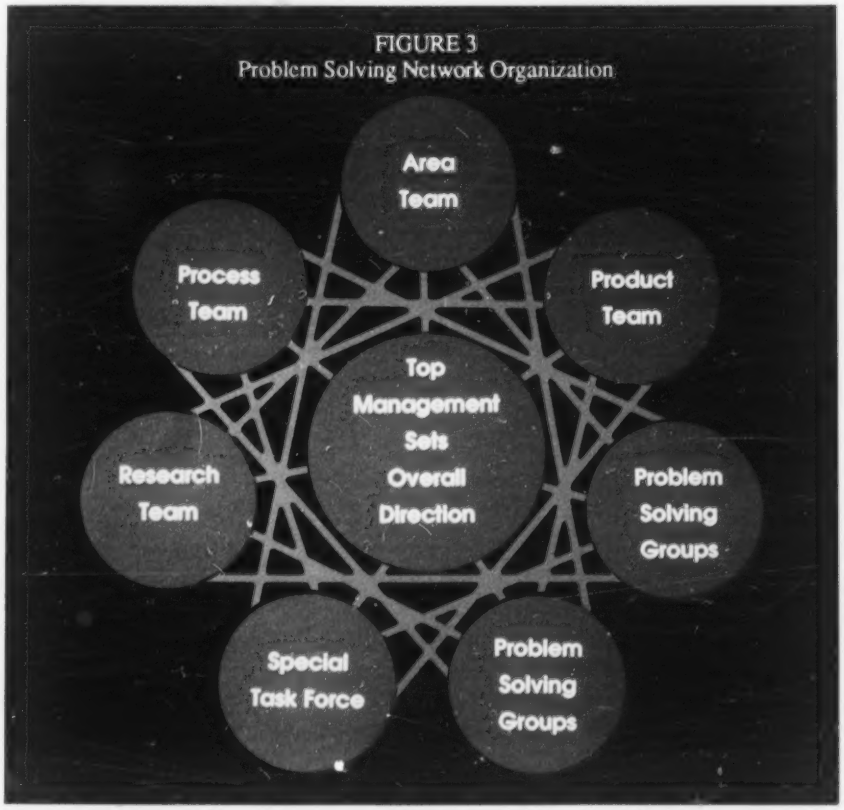
Xerox's changes have been inspired by a process called Leadership Through Quality. A heavy emphasis is placed on teamwork and serving the internal customer. The best-known example of this change at Xerox is the formation of "commodity teams" to deal with suppliers. The teams train suppliers, work with quality problems, cut supplier lead times, and develop a joint understanding with the suppliers about the nature of the suppliers' manufacturing processes. This approach has led to nearly a 50 percent reduction in the materials cost of new Xerox copier designs.

Xerox's old functional organization is not what it used to be: teams dominate the actual work. Everyone tries to serve the internal customer who should benefit from their work. An outsider to Xerox, unfamiliar with the nature of change, would be hard-pressed to identify the structure of the new Xerox organization.

Goodyear has made substantial changes in plant organization, beginning with their tire plant at Lawton, Oklahoma. When the plant started, it was supposed to cultivate new ways of organizing; instead, the managers and workers there began operations with a typical "functional silo" organization chart. Over time they began to break down the walls between the departments. Today, the Lawton plant is divided into areas managed by "business management teams" who administer the functions necessary to run their corner of the plant. Gone are such functions as centralized maintenance and centralized industrial engineering. Walls between departments tumbled down as staff departments were broken up, and members were assigned to general management areas. The Goodyear migration to a problem-solving network is still far from complete, but Goodyear represents an interesting U.S. example of changing an organization to overcome functional "siloism."

Companies have just begun to address the manifold problems which pop up when organizations shift from hierarchy to network. For instance, if a person feels a strong obligation to an internal customer, the wishes of the customer may sometimes conflict with those of the boss.

FIGURE 3
Problem Solving Network Organization



A problem-solving network is a very flat organization. There are few higher-level positions to which people can advance, so how can companies keep them motivated? One vision is that manufacturing companies might begin to look more like consulting companies in the method of promotion: people enter at the associate level and get promoted through two or three more levels up to the top of the company at the managing partner level. Promotion is based on overall merit and seniority. This kind of organization would seem strange in large manufacturing companies having ten or more organization levels between the president and the workers, and many problems are liable to arise. For example, with only a few organization levels, there are few promotions available, and any promotion given could be a major event. Other forms of recognition and reward must replace frequent promotions.

However, the change in organizational reward may not be as difficult to cope with as changes in managerial behavior. In the new environment, bosses do not do all the thinking and make all the decisions. As responsibility is pushed to low levels, the method of management changes more to coordination of problem-solving than to collection of facts and personal problem-solving: there is less "direct command."

Many organizations today are moving in this direction, but it is an evolution in which people learn to work and behave in new ways. The major problem of implementing JIT/TQC appears to be the problem of changing human nature, and it is not an entirely intellectual change. A major milestone is the adoption of a different attitude by managers -- an attitude that their major duty is to develop the team of people around them. This management idea has long received lip service, but now it must be practiced in reality. The manufacturing companies that move most rapidly into the "new manufacturing" recognize that the basis of all other improvement is the development of every person in the company to use 100 percent of his or her ability. Much of the rest is only a set of techniques which enable an organization to consistently improve on its prior levels of performance. ■

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TQM AND COST MANAGEMENT: NEW DEFINITIONS FOR COST ACCOUNTING

by James M. Reeve

The impact of Total Quality Management (TQM), both as a philosophy and in practice, is nothing short of a dramatic change in management paradigm.[1] Paradigm shifts are sometimes difficult to recognize when they are underway. New ideas frequently meet with hostile receptions from the proponents of the old paradigm. Questioning the new paradigm as "faddish" or "management's new program" will frequently be echoed.

This is not to say that skepticism of a paradigm shift is unhealthy. Too often the alleged "new paradigm" has proven to be a failure. The victory of the new paradigm comes only with evidence of its economic success.

The evidence for TQM is quickly mounting. Indeed, the success of TQM is becoming so convincing that the long-term survivability of firms that reject this paradigm may seriously be brought into question.

Any paradigm change will have a fundamental impact on the organization and all of its functional areas. Some functional areas will be drastically reduced in importance or eliminated, while others will be redefined or merged. There are numerous changes on the horizon for cost accounting.

From Cost Accounting to Cost Management

Table 1 provides a brief listing of the fundamental changes occurring in the manufacturing environment that are requiring a new response on the part of management. The table compares conditions in the present to those 30 years ago and identifies the im-

1. For a more detailed discussion of the philosophy behind TQM, refer to Carothers et al. (this issue) or K. Ishikawa, *What is Total Quality Control?* (Englewood Cliffs, N.J.: Prentice Hall, 1985).

TABLE 1
Changing Demands on Accounting Systems

PAST	PRESENT	COST MANAGEMENT ISSUE
Uniform Products	Large Product Variation	Highlight cost barriers to flexibility: long set-up times, excessive inventory, large batch production.
High Labor Content	High Technology Content	Increased importance of capacity and technology cost tracing to products. Labor tracing less important.
Economies of Scale	Economies of Scope	Performance measures move away from promoting production toward promoting flexibility.
Low Overhead	High Overhead	Overhead cost management much more important. Non-volume cost drivers replace direct labor to more accurately trace overhead to products.
Domestic Competition	Global Competition	Renewed importance of quality and delivery performance. Cost competitiveness paramount.
Static and Piecemeal Improvement	Continuous Process Improvement	De-emphasize standards and sub-unit measures. Emphasize system waste and lead time performance. Simplified accounting.
Stable Product Life Cycles	Short Product Life Cycles	Emphasize product life cycle costs. Trace R&D and new initiative costs to the product.

pact of the change on cost accounting systems. A number of major themes that influenced the change to cost management are discussed in the following section.

Scope Vs. Scale

The marketing environment of the 1990s will require firms to produce a much higher variety of products than in the past. Consumers will reward the manufacturer that can provide line extensions, new features, and tailored products to narrow market segment needs. This competitive environment requires companies to respond to competitor's new product offerings or risk ignoring new market niches.

Unfortunately, the additional variety imposed by market demands will place increasing strain on manufacturing facilities. Some of the new manufacturing technologies, such as just-in-time inventories (JIT), flexible manufacturing systems, group technology, and focused factories are attempts to increase the responsiveness of production to the requirements for higher variety. The ultimate objective of these methods is to bring the unit cost of a lot size of one equal to the unit cost of a lot size of 1,000. Manufacturing is, in a sense, trying to break the age-old rule of economies of scale.

Strategic Product Costing. Cost management systems will have to respond to this new environment in a number of ways. The accounting system must correctly communicate the profitability of products. No longer can we think in terms of just sales volume for new product entries. Products must either support other products or contribute to profitability on their own. The determination of correct product costs is one step toward cost management. Correct product costing will not be a universal need. Product costing is necessary for strategic purposes when product pricing decisions are made more on a cost plus basis rather than a market basis. Secondly, correct product costing will be important only when the systems that are responsible for producing and delivering product variety to the customer have cost structures that prevent them from achieving full flexibility. In other words, the costs of complexity have not been substantially removed.

An example involves a paper company. The company owned a plant that was responsible for producing over 400 different varieties of paper (i.e., caliper, coatings, color). An analysis indicated that 10 percent of the product codes generated 60 percent of the revenue. The accounting system reported that the high-demand items had overhead costs of $20/ton, while the specialty items cost $26/ton. The cost system in use assigned costs to products on the basis of manufacturing time in the paper and converting machines. A strategic cost analysis was performed to more accurately trace the costs for shipping, warehousing, production control, changeover, and production scheduling for the various products. The specialty products were heavy users of these resources relative to the commodity products. Since specialities ran through the paper converting machines in short runs they required changeovers, high scheduling costs, and longer warehouse time. Essentially, the firm was unable to economically produce the variety required by their product line.

The strategic cost analysis revealed that the overhead cost per ton for the specialty papers was not $26/ton, but was closer to $1,000/ton. Needless to say, management was shocked by this result. Apparently, specialty papers added to the complexity of manufacturing. The company's current cost system cross-subsidized these costs in favor of the specialties to the detriment of the commodities. Management had to decide whether to change manufacturing strategy to eliminate the costs of complexity, reprice the specialty papers, eliminate production of specialty papers, or simply do nothing, and risk losing market share of the high-volume papers.

Performance Measures. The influence of the economies-of-scale production philosophy is strongly reflected in many cost accounting systems. The old paradigm emphasizes producing, under the belief that using resources to produce to capacity is economically sound. The TQM management philosophy opposes this perspective and emphasizes production of only what is needed. The throughput of manufactured goods to inventory is not economically sound, therefore, measures that encourage this type of behavior are questionable.

An example is earned standard hours in a work center. This approach to work center control is based on a "push" method of production. Work is pushed through the production system

while the workers are evaluated on their ability to earn standard hours in the work center. This kind of measure can lead to excessive work-in-process inventory as employees produce to standard, even when there is no demand for the work downstream. In a sense, each work center has its own unique pacing. There is little in the way of system balance or global pacing. In contrast, the "pull" method of production emphasized by JIT is inconsistent with these chargeback accounting systems at the work center level. Under a pull system, work is demanded by downstream centers. If there is no demand, there is no production. Credit for work accomplished under the JIT philosophy occurs only when the product is throughput to sales.

The incentive in many accounting systems to overabsorb the fixed overhead cost budget is another example of a misplaced emphasis on economies of scale. The reporting of volume variances at the cost center level will encourage managers to produce in excess of normal capacity in order to get a "favorable" volume variance. This favorable volume variance is fiction. The measure is not favorable if the higher production level results in extra scrap, rework, inventory, downstream difficulties, and large batch sizes.

The batch and continuous processing industries frequently emphasize unit cost as a plant-wide performance measure. Most production managers know that this measure is influenced most by the denominator level of activity, since so many of the numerator costs are fixed in the short term. Produce more and the unit cost will go down; produce less and the opposite will occur. Therefore, as a measure of effectiveness and efficiency, the unit cost number is at best crude, and at worst counterproductive, in influencing the organization. An overreliance on unit cost will lead to scheduling decisions that produce in large batches to minimize switchovers. Unfortunately, large batch production, while minimizing switch costs, is a prime ingredient leading to lack of customer responsiveness, lack of flexibility, large inventories, dependence on forecasts, high scrap rates, and high overhead costs. The accounting system should emphasize the global effects that emanate from long switchovers, but should not encourage the narrow emphasis of merely avoiding switches through large batch production.

Labor Vs. Technology

The tracing of direct labor cost to products and using direct labor to allocate overhead were reasonable procedures in a time when direct labor consisted of 25-50 percent of the product cost. Today, when direct labor is only 5-10 percent of the total product cost, there is some question as to whether elaborate labor reporting systems are still required. In the interest of simplicity, many firms are dismantling their labor-based cost systems. No longer are direct employees required to fill out time tickets or associate work with jobs. As a result, a great deal of administrative effort is being released.

Firms are beginning to treat direct employees as indirects, from a management, as well as accounting, perspective. Floor employees are taking on greater responsibilities. These responsibilities go beyond the simple "touch" labor tasks to include statistical process control, work content analysis, basic machine maintenance, housekeeping, process improvement and multiple work skills. As a result, employees are no longer stationed at one job with one machine, but move within the facility to different tasks at different times. The old job order approach to labor reporting is virtually unworkable in such a setting.

At one extreme is the case of highly automated production facilities, such as flexible and computer-integrated manufacturing systems.[2] In these systems, the costs of production are associated more with the technology than with the labor. The automated system will work unattended in one instance, while in another instance, many individuals will be involved in loading/unloading, tool changes, fixture changes, and maintenance. The labor costs belong to the cell. Labor is not reported to the product level due to the arbitrariness and administrative difficulty of tracing these costs to the product. In contrast, some costs generally thought of as indirect, such as tool engineering and numerical control programming costs, are appearing more direct. These costs are significant and can be directly associated with a product. In response to these new realities, some firms are going so far as replacing the direct labor cost category with a new cost category--direct technology costs.

Static Vs. Continuous Improvement

The hallmark principle of TQM is to continuously improve systems toward the objective of creating consumer value. A valid question, therefore, is how well do traditional cost accounting systems support this objective? Not very well, many are arguing. Take, for example, the use of a standard cost system. Standards used in performance evaluation are antithetical to a continuous improvement philosophy. Standards tend to place an upper limit on improvement, or hide improvement possibilities. In one case, a paperboard manufacturer decomposed the standard cost of materials and determined that 20 percent of the cost was built-in scrap. Many firms use engineering staff time to develop and negotiate standards, whereas time invested in systems improvement would be better spent. The cost management system should identify waste in the system, and thereby promote its removal.

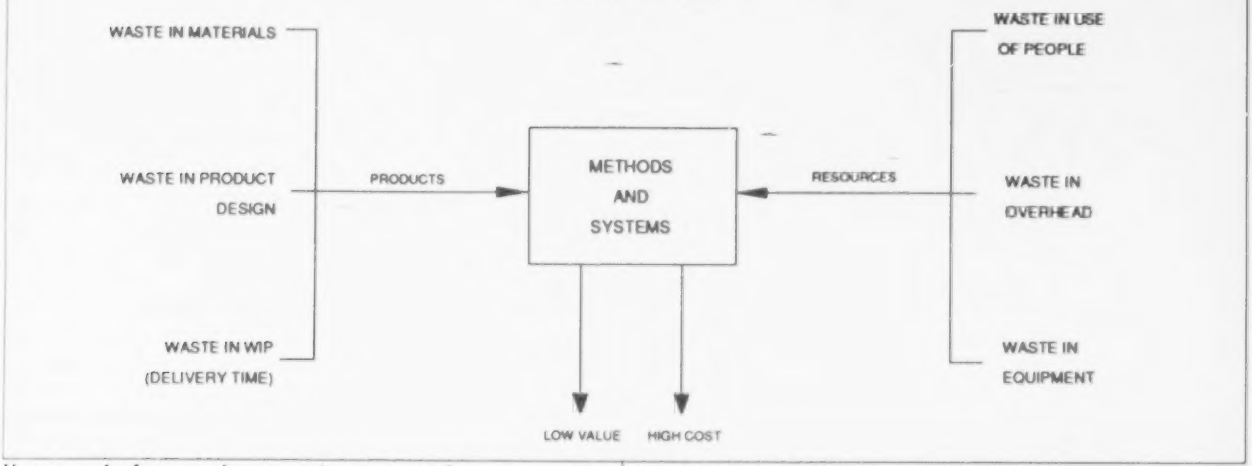
Figure 1 illustrates the sources of system waste. These sources emanate from the use of resources or from the features of the product itself. Resource waste can come from people, overhead, or equipment usage.

People. A facility that has numerous labor classifications is almost guaranteed to have waste in the use of people. A high degree of task specification will require manning levels to support peak capacity. If the total headcount is not flexible (it generally is not), then the inability to move people into different tasks will require slack time in employee schedules. For example, if the line worker is unable to do routine maintenance or housekeeping activities, then specialized individuals must do these tasks. The proliferation of specialties requires extra cost to schedule work, downtime during work changes, and excess capacity due to unevenness of work scheduling.

In another example, the use of people can be ineffective due to poor operational definitions of the work itself. The CEO of

2. See James Reeve, "Product Costing and Performance Measurement for Flexible Manufacturing Systems," *Justification Methods for Computer Integrated Manufacturing Systems*, ed. by H. R. Parasei, T. L. Ward, and W. Karwowski (Amsterdam, The Netherlands: Elsevier Science Publishers, 1989).

FIGURE 1
Sources of Waste



Komatsu, the Japanese heavy equipment manufacturer, was observing the work being done in a U.S. construction equipment manufacturer. For a particular operation, 10 people were strenuously moving a piece of fabricated material. The CEO commented that the plant looked like a Komatsu plant of 20 years ago. Specifically, he said that the same operation today in Komatsu would take only two people with the exercise of little effort. In other words, the work was made easy. Since the work was easy, fatigue and manning levels were lower, and productivity was higher.

Overhead. Waste in overhead arises when activities are accomplished that are not required by the customer. If inspections could be eliminated without loss of quality, the customer would not notice the difference. If material movement and warehousing could be eliminated, the value added to the customer would not be affected. The operations of the firm need to be reviewed in light of the customer's definition of value added to the product or service. Using this definition implies that there are many overhead functions that may not be necessary, but exist only because systems are inadequate. One example is a flow control valve company where 60 percent of the cost structure is overhead-related. The major support departments consist of inspection, WIP handling, raw material handling, finished goods handling, set-up, production control, and purchasing. These costs can be dramatically reduced by moving to a different production technology that doesn't rely on inventories (JIT), in-line inspections (SPC), production control (Kanban techniques), or set-ups (single-minute exchange of die techniques).

Equipment. Equipment waste can reveal itself in a number ways. Redundant systems designed to protect system throughput and rework equipment are examples of nonessential equipment investments. The ineffective use of equipment is also a form of waste. The time that equipment is idle due to set-ups, unscheduled breakdowns, and scrap production time are all examples of ineffective equipment use. The time that equipment is idle due to lack of demand is a different issue. Pure excess capacity costs are organizational costs that do not "belong" to either manufacturing or marketing, but the problems of these costs must be solved jointly. There must not be performance incentives to fill capacity if the demand does not exist for the product. Likewise, an incentive to eliminate set-up time, breakdowns, and scrap production time should be a focus for improvement efforts, even if their elimination results in idle time. Visible idle time is opportunity; invisible idle time can lead to unnecessary capacity increases when demand increases.

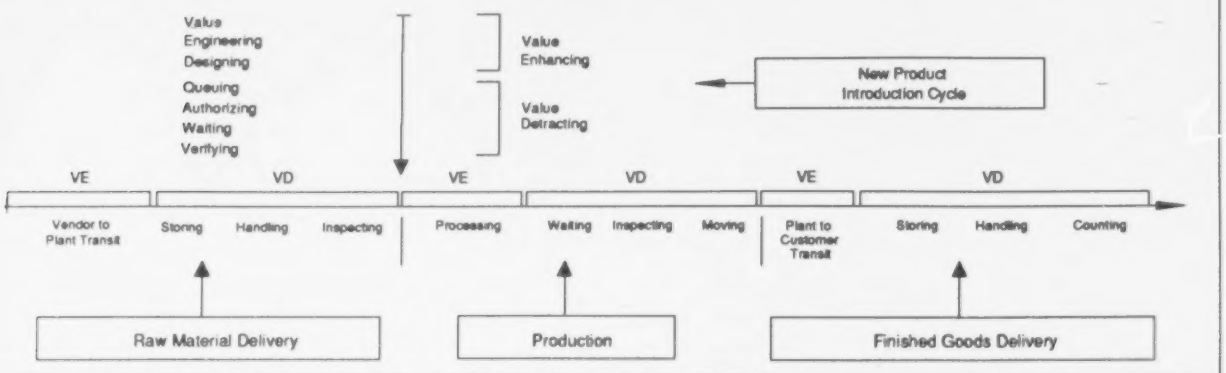
Material. Material waste can be due to any number of reasons. The use of statistical process control is one technique used to reduce the incidence of material waste from scrap and rework. Accounting and engineering should support the elimination of scrap by discouraging the practice of building scrap into standards. Scrap and excess material usage should be made visible, even if present systems are not capable to specifications.

A word of warning is useful at this point. Accounting numbers, by their very nature, are ends measures. They are not means-oriented, nor will they ever likely be such. By implication one should not use accounting reports to determine the causal factors of process problems. Accounting reports can confirm improvement efforts and direct the improvement priorities by economic means, but the actual improvement work will likely be done through the use of engineering measures and engineering tools. The accounting system should report the financial impact of such work. Accounting provides the linkage from the subsystem improvement work toward the broader financial objectives of the organization.

Design. Much could be said about the importance of initial product design in reducing the amount of system waste. The degrees of freedom (ease of change) are greatest at the design stage. Once the designs are released to production, the cost of engineering changes grow exponentially. It has been reported that at one company the cost of each engineering change during production averaged $10,000.

The importance of value engineering and financial support at the design stage is being recognized by world class companies. A number of firms, such as Xerox, are providing extensive cost estimation support at the design stage. Many product design teams in the auto industry now include accounting personnel along with engineering to provide information on the cost impact of design decisions. For example, if an assembly could be designed with 12 different fastener types, versus being designed

FIGURE 2
Lead Time Performance



with only two different fastener types, the cost of the assembly would obviously be greater where the unnecessary complexity exists. The greater the number of assembled parts, the greater the chances for defects, vendor support costs, scheduling costs, raw material storage and release costs, shortages and substitutions, and errors in location, scheduling, or the bill of materials. All these costs can be avoided by considering costs during the design stage. Tektronics Corporation has decided to influence designer decisions by allocating the material overhead costs to products on the basis of the number of parts in the design. In this way, products that use nonstandard parts are penalized with a higher production cost, compared to products with common components.

Delivery time. Time is a critical source of competitive advantage.[3] Time can be thought of as occurring in four important cycles. These cycles include the raw material delivery, production, finished goods delivery, and new product design. The time it takes a product or service to be delivered through each of these cycles is associated with cost. The longer the cycle time, the greater the cost, and the slower the organization in responding to the consumer demands. One of the critical variables that impacts the time cycles is the amount of imperfection or variation in the system. Unreliable systems require extensive lead times. Figure 2 illustrates the four important cycle times.

Notice that the lead time of the major processes have both value-enhancing and value-detracting time. The times involved with the product's delivery, production, or design are the value-enhancing times in the cycle. The value-detracting times in the cycle involve the wait, inspection, and move times. These times are invested in the product, but if eliminated, they would not be missed by the customer. The longer the product is in the cycle, the greater will be the resources consumed or lost from errors, record keeping, excess capacity, expediting, excessive complexity management, low product variety, and lost sales.

A widely-reported statistic is the ratio of value-enhancing to total manufacturing lead time (the value efficiency ratio). In North America this ratio is reported to be approximately 5 percent. Whereas in world-class companies, it approaches 50 percent.

The philosophical emphasis on lead time performance is fundamentally contradictory to traditional thought. For example, suppose a process has a manufacturing lead time of 100 minutes. The manufacturer with a lead time efficiency ratio of 5 percent would have five minutes of actual processing time, while the other 95 minutes would be due to wasteful activities. The typical management focus is to make the 5 minutes faster. Accounting reports will allocate costs and determine department operating costs on the basis of the 5 minutes of operating time. The costs of the 95 minutes are called overhead and spread to products on the basis of a burden rate. No one owns the overhead rate. There is no incentive for system improvements because burden rates are treated as if they were fixed organizational costs, belonging to no one. Moreover, burden rates are highly aggregated accumulations of many of these value detracting costs, and therefore become hidden from objective effort.

The world-class manufacturer which also has a five-minute operating time, but focuses instead upon improving the waste implied by the 95 minutes, could eventually achieve a ten-minute lead time at a value efficiency ratio of 50 percent. At this point, work on the five minutes of operating time may be the next logical step. The short lead time manufacturer is competitively stronger on the basis of lower cost, more reliable delivery, higher quality, nearness to the customer, and higher learning (more repetitions in a given time period). These are powerful competitive weapons.

Conclusions

The cost management system should measure system waste, so that the systems improvement work can be directed and linked to the broader strategic objectives of the firm. Moreover, performance measures such as the lead time efficiency ratio, flexibility measures, length of set-up, and equipment effectiveness ratios should supplant the traditional production-oriented measures. As firms move toward the TQM philosophy, all parts of the organization must be synchronous. One tool to achieve this commonality of purpose is the measurement system. It is inconsistent to speak of embracing TQM, while simultaneously emphasizing, through the measurement system, a completely different and outmoded philosophy. ■

3. G. Stalk, "Time: The Next Source of Competitive Advantage," *Harvard Business Review* (July-August 1988): 41-51.

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BROKERING MARKETING INTO TOTAL QUALITY

by William B. Locander

The marketing function is a vital piece of the worldwide competitive puzzle facing many companies today. In the future, a firm operating under world-class quality and productivity standards will have to include the marketing function as the company's eyes and ears to the marketplace.

While a full exposition of marketing's role in a quality system is beyond the limited space provided here, there are areas which deserve management's attention:

- Marketing values as an organizational force
- Information as systems-driven
- Marketing's role as a stakeholder in quality delivery
- Customer satisfaction measures as a final checkpoint

Marketing Values

If we consider meeting consumer needs as the primary goal of all business system efforts, then we understand the first commandment of marketing: customer needs are the driving force in all we do. Creating the attitude within a company that the customer is the most valued commodity is very difficult. As they develop, most organizations lose sight of the customer's needs and begin making decisions with internal considerations in mind.

Establishing a "customer empathy" perspective is imperative to being a market-driven company, and that means seeing the customer's side of things and acting in the customer's best interest. For example, companies that market industrial products often have problems with billing customers--that is, getting the bill correct and communicated correctly to the customer the first time. If the customer is billed improperly a number of times, we then have a billing process problem which is making an impression on the customer. Think of this same customer when deliveries are late and the product

defect rate is higher than the competition. What we have is a quality problem--but one defined by the customer's definition of what quality means to his firm.

As we can see from Figure 1, filling the need with the right product configuration at the right price, at the right time, and in the right quantity requires the actions of the entire value chain to meet even the most simple need: "I want a pair of black shoes, size 9D, in that style." This simple expression of a need has production, engineering, distribution, inventory, and accounting information implications for the firm which is trying to provide the product in a timely manner. Thus, marketing information concerning customer needs becomes of paramount importance.

Marketing Information

Measurement is an integral part of a quality management system. However, most measures focus on process variables associated with manufacturing and distribution. While variables such as throughput, cycle times, and work-in-progress inventory are extremely important, measurement downstream toward the ultimate consumer tends to be less understood. If one really wants to understand customer needs, a number of methodologies are available:

System Measures

- Dollar sales
- Warehouse withdrawals
- Market share data
- Return on sales

Individual Measures

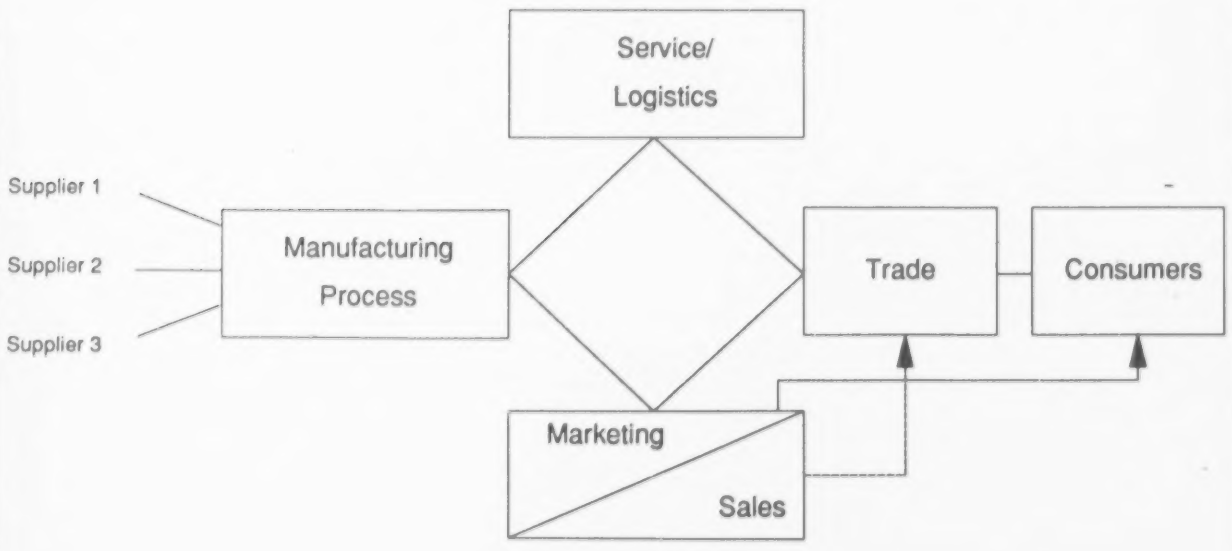
- Survey data
- Observations
- Experiments
- Panel data
- Executive interviews in the distribution channel
- Sales force feedback

The system indicators are those global measures of how the system is operating. Looking at things like dollar sales or warehouse withdrawals will show aggregate flows within the system to the consumer. Once there is an understanding of how well the system is doing in aggregate, then one can utilize the individual level methods to examine needs and wants. While there are a wide range of methods which can be used to understand customer needs, it is important to realize that the goal of managers using these methods should be to really know and understand customer requirements--that is, what the customer values. There are distinct trade-offs between large-scale survey methods and devoting the time and money to visit with the trade to get their impression of what the consumer wants in a product. Regardless of the methodology, management must become extremely well versed in knowing what is valued by their customers.

Some ideas to help managers understand consumer needs include the following:

- Establish a posture of studying the market on a periodic basis.

FIGURE 1
Business System



- Get close to the studies being done, and take an active part in knowing what *you* will *know* when the field work is done.
- Rely not just on massive field studies, but get out with the customer yourself. See if what you experience with the customer is reinforced by the field studies. If not, resolve the inconsistency before taking action.
- Go to the distribution channel and tap their years of experience with the customer. Learn what they know!
- Look at all the data within your company and form your own conclusions. Don't rely on someone else's interpretation. If your opinion differs, have a dialog and resolve the inconsistency in perceptions.

If trade and consumer needs are examined as part of the business system prescribed in Figure 1, then a system's perspective starts to take focus. Balancing trade and consumer needs with the capability of production and logistics function is critical to customer-driven management.

Marketing's Stake in Quality

All firms are made up of stakeholder groups who have a "vested interest" in the firm's operations. Taking a stakeholder approach to quality shows the varying perspectives brought into the management process. Figure 2 shows five major stakeholder groups in total quality, including the customer. For the sake of argument, manufacturing and engineering have been combined into one group as well as marketing/sales, accounting/management information systems, and service/logistics. The arrows in Figure 2 show all of the stakeholder relationships which must be considered to manage the business system. From a total quality and marketing perspective, there are two important factors to consider in Figure 2:

- The "within" marketing function aspects of total quality
- The "between" marketing and other functional relationships (shown as a, b, and c)

First, the "within" marketing function activities concern the efficiency and effectiveness with which the work is accomplished. The "cycle" time for producing an advertisement is something which can be flow-charted from a work flow perspective. Reducing the time, effort, and work required to produce an ad campaign with an external agency is an example of "within" type quality management. A fishbone analysis of the sales force effort might be another example of "within" marketing quality management. Figure 3 shows a generic fishbone diagram to determine the quality effort of a sales force in getting orders.

Notice that a tool like fishboning can be a very insightful exercise for sales managers. Figure 3 shows that this

FIGURE 2
Stakeholders in Total Quality

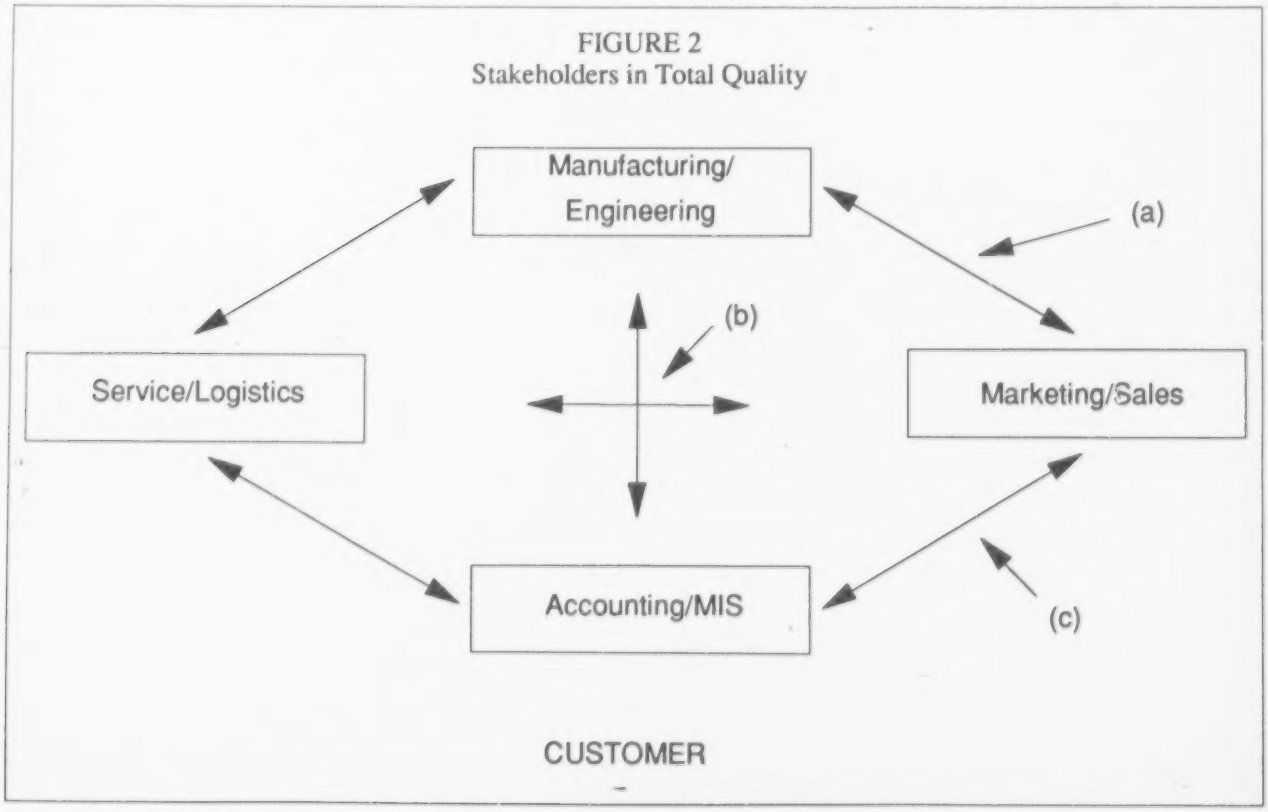
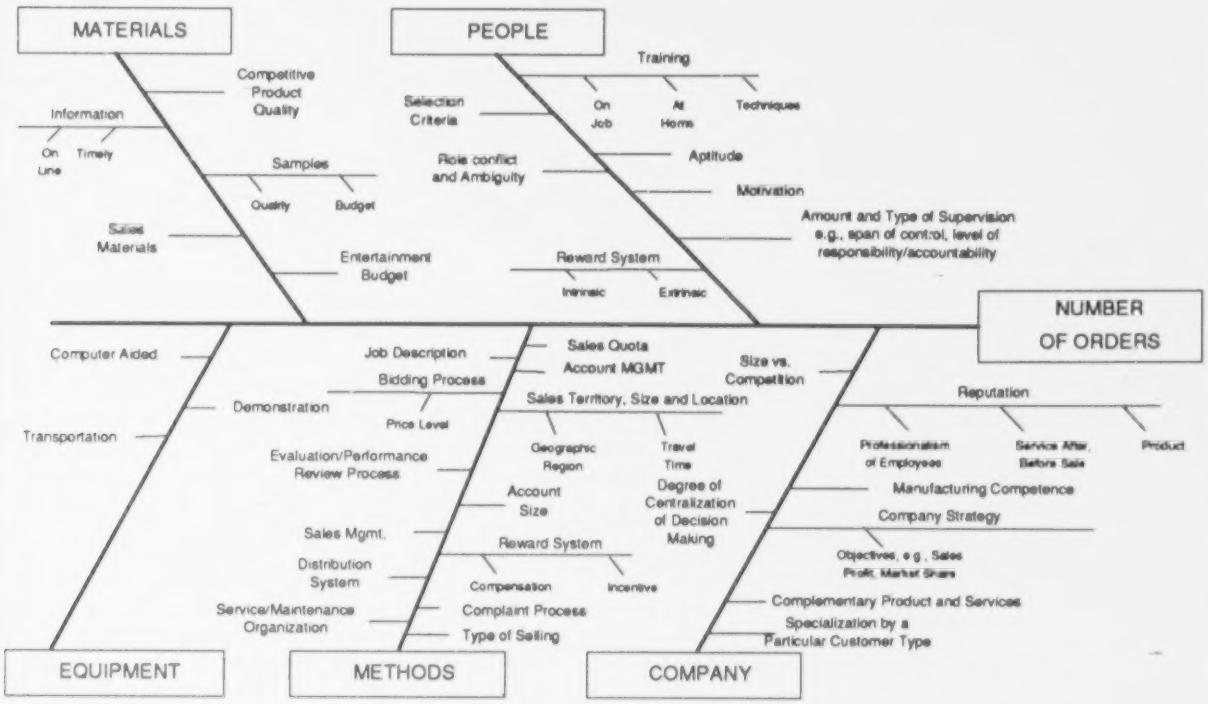


FIGURE 3
Factors Affecting Orders



analysis yielded five major factors affecting the number of orders:

- People -- Selection and Training
- Materials -- Sales Support Budgets
- Equipment -- Technology Aids
- Methods -- Selling Techniques
- Company Image -- Reputation with Customers

Each of these major factors is supported by additional factors. Figure 3 is an example of how basic quality tools can be used in a marketing setting. What the figure provides to management is a map of cause and effect factors which ultimately support the company's sales presence with the customer. Figure 3 is not meant to be a complete fishbone, but rather an example of what can come from the exercise of analyzing the work of making an effective sales call. It does, however, give us some rich insights into the complex nature of managing a high quality sales force.

While the "within" function issues are very important, it might well be that managing "between" relationships will separate world-class competitors from those who fail. The arrows noted a, b, and c in Figure 2 show the important stakeholder relationships affecting marketing. At this point, it is important to understand that variation-producing behaviors must be understood and controlled within the system. An examination of the three interrelationships of the functional areas as portrayed in Figure 2 will help explain variation-producing behaviors. If the marketing group creates too many promotions or "specials" in the name of the customer, the result will be excessive and unnecessary changes (variation) in the plant's operations. Unplanned change (variation) is the enemy of any system. The more accurate the promotion planning and execution within the company, the lower the production costs, and also the lower the rework and waste.

On the other hand, if plant management is not continually improving its flexible manufacturing capability, the market will go to competitors who can meet demand on a more timely basis. Flexible manufacturing systems are a tremendous marketing asset. The ability to meet customer requirements on short notice will yield substantial advantages in the marketplace.

The second relationship--between marketing and service/logistics--is also important from a variation behavior perspective. If marketing/sales managers forecast unit sales by month, there usually will be a build up of inventory for planned promotional events or peak seasons. Continual communication be-

tween marketing, production, and the inventory control managers is required to manage the spiked inventory effect. The closer the company can come to forecasting their peak-season sales, the lower the holding costs and the higher the system throughput.

Information is the lifeblood of marketing. The timely and accurate collection of various kinds of consumer behavior information is the critical driving force in the business system. However, the ability to create and maintain a "company memory" of all the various types of collected data is critical. Accounting information system data generally do not serve this purpose very well. The creation of a management information system which monitors the marketplace must be created to bring together all we know about our customer's needs. Marketing's role is to maintain, enhance, and feed the system its valuable data. However, if there is no reward for systematic and timely feedback to the customer data base, then creating an information system will be fruitless.

Managing stakeholder relationships is vital to a value added system's performance. Senior executives must realize that managing the politics of stakeholders is an integral part of building cross functional processes designed to achieve customer satisfaction.

Customer Satisfaction

After customer needs have been understood and purchases made, customer satisfaction becomes an important system parameter. Satisfaction is an "after the fact" measure which is a final control on our system's performance. However, customer satisfaction indices must measure what customers want in the first place. An accurate understanding of customer needs is preliminary to an effective customer satisfaction program. From the consumer viewpoint, the important question is "How do I feel about the product, brand, or company?" Here lies the acid test for effective marketing. However, there is more to understanding and measuring customer satisfaction than meets the eye.

Customer satisfaction is a state of mind and is an emotional reaction which comes from all that the customer experiences with respect to a company. The consumer who opens and finds that the soft-centered candy has leaked during shipment is not concerned with who is to blame in the company. The reaction is more likely to be one of "I expected this to be a tasty, high-quality product, not a leaky or dirty product." One can see that it is the interaction of all stakeholder efforts which creates the final and lasting impression on the customer.

The measurement of satisfaction is getting serious attention by market researchers today. Questions such as "What is customer satisfaction, and how do I measure it?" are of vital concern to managers charged with developing these measures within companies. Some current thinking would argue that satisfaction is a function of customer expectations about what the product should do compared to its actual performance. The measures can be global in nature or done on an attribute by attribute basis. Both types of measures would probably be beneficial.

What companies are concerned about is the reaction to beliefs about the product which do not meet with the expectation standard. How does this disconfirmation affect repeat business for a consumer brand or industrial product?

Overall, the measurement of satisfaction requires that methods be well thought out and founded on the conceptual understanding of satisfaction. The critical question of the future is "Do we try to create a satisfied customer, or do we exceed expectations so that there is an excited customer?" The world-class competitor of the future will more than likely have his customers well beyond the satisfied state and to the level of being excited about his products. ■

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THE U.S. PRODUCT DEVELOPMENT DILEMMA[1]

by Clement C. Wilson

It seems incredible that the ability of many large U.S. companies to develop superior and innovative products for world markets is worse now than was the case 25 years ago.

In 1981, my product development engineering team decided to make a direct comparison of our company's ability with that of a much smaller Japanese company by asking the Japanese to manufacture a product that we had also planned to manufacture. The Japanese company demonstrated the ability to convert the product from drawings to a dozen factory prototypes in 50 percent of the time, with 60 percent of the people, and 25 percent of the tooling dollars. When we examined the Japanese methods, we found the techniques to be much like those which had been practiced by the smallest division of our company in the early 1960s. The parts vendors were close (within 20 miles), the engineers knew the manufacturing processes well, and the assembly people knew their product well, so that only a minimum number of support people had to be in the factory.

In short, the well-integrated engineering and manufacturing operation of the Japanese was simple and easy to understand. They also had been pursuing a "zero-defects" quality program for 15 years. With the exception of the "zero-defects" program, all the techniques they were using were *old* rather than *new*!

Focusing on the Problems

Basically, the comparison revealed these factors:

- U.S. product development and manufacturing systems are antiquated.
- The Japanese systems are much simpler and need fewer people.

1. See Clement C. Wilson and Michael E. Kennedy, "Some Essential Elements for Superior Product Development" (The University of Tennessee, Knoxville, College of Engineering, Superior Engineering Design Program, 1989), photocopied.

- U.S. systems are complex due to increasing specialization.

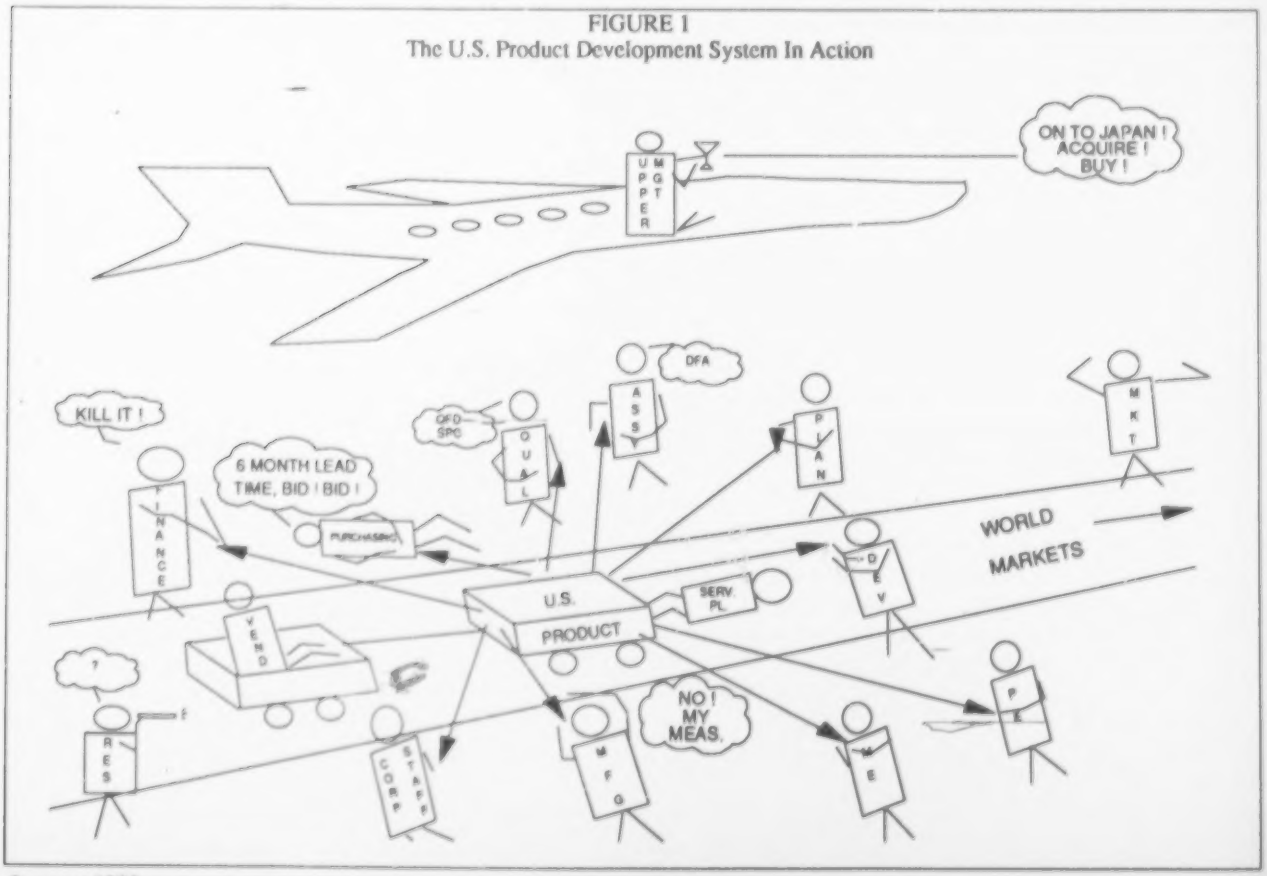
The vast number of specialized functions in a large American (matrix) organization can lead to the situation described in Figure 1. In this figure, the development engineer is pulling his "new product wagon" down the road toward the world marketplace. Other members of the company are "helping" him as they pull on their ropes. The product engineering manager says, "Let's redesign it for a two cent manufacturing cost reduction." The manufacturing engineering manager says, "My mission is to protect manufacturing from engineering. Let's redesign it; we can't put a screw in from the bottom!" The manufacturing manager says, "I can't support this new product; it will ruin my measurements with its learning curve." The corporate staffer says, "I nonconcur with this one; the next one surely will be better." The researcher who had earlier contributed a fragile experimental prototype says, "I don't know what all the fuss is about, I showed them how to do this technology two years ago. Aren't they finished yet?"

The vendor being pulled in the wagon is saying, "If you don't ask for unreasonable quality or accuracy, we'll meet our production and cost targets." The finance manager's comment is, "Kill it before we pour any more money down this rat hole." The purchasing manager says, "This part requires a six-month lead time, and our bid procedure takes six weeks. What do you mean, you want it in 30 days?" The quality assurance manager says, "Let's start over with Quality Function Deployment (QFD) and SPC in mind." The assembly engineer, just back from a design-for-assembly course, says, "Let's redesign it so that when we throw all the parts into a corner, they will fall together in a correct assembly." The planning manager says, "Let's get it out so I can get back to my new job as marketing manager." The marketing managers, eagerly awaiting a competitive product, are demanding, "This product is a year late. Let's have a 'market-driven' product development organization, responsive to the customer needs." The development engineer, the only one pulling straight down the road, says, "I don't understand why no one else seems to care but me. Next time, I won't care."

Just at that moment, a jet passes over, carrying the upper management to Japan. The comment by the CEO is "Let's acquire a product from the Japanese and cut these ridiculous R&D and manufacturing expenses. Our people are simply not competitive!" It is not clear whether anyone has told him that the profit gets split on an acquisition.

Although there is some humor in this scenario, there is much truth as well. It is not fair to infer that the only person really trying to get the product out is the development engineer; yet, the most serious comment comes from him because he is discouraged by an organization with so much conflict and resistance. My experience has been that these critical design engineers are leaving product development for equally lucrative but less frustrating jobs for this very reason. And when they leave

FIGURE 1
The U.S. Product Development System In Action



development engineering, a creative skill is lost that cannot be replaced. The next generation of engineers who do not have the knowledge or time schedule to engineer an innovative product will simply procure it from the Japanese. If the company decides later to develop and manufacture products in the United States, *they will not be able to do it because the engineering design skills are no longer in place.*

Taking Action

The Xerox Corporation was one of the first American companies to recognize the organizational problem and take major action. In February 1986, L. Lyndon Haddon, VP, Xerox Corporation, told the Copying and Duplicating Industry Conference that Xerox was being forced to change its product development system to meet the competitive challenge of the Japanese. For three years in a row the Xerox copier market share and profit had dropped, and the company had to take action. Mr. Haddon stated that the Xerox product development "system created to prevent errors . . . almost prevented product delivery" because it created such serious slowdowns with its need for concurrences and transfer problems across organizations.[2] The results of the company's complete organizational changes were resoundingly successful. In November 1988, the latest Xerox Product Delivery Process stressed the importance of focusing all employee efforts in new product development and product quality. The Xerox actions illustrate their evaluation of the seriousness of the Japanese challenge.

A second major concern is that companies that do not change dramatically will eventually go out of business when faced with competition from the Japanese. During the last 20 years, Japanese firms have repeatedly demonstrated the ability to develop and manufacture almost any product they select, with the best performance, lowest cost, and highest quality in the world. They integrate engineering with manufacturing and form long-term partnerships with subsidiaries and vendors. They simplify their manufacturing processes, enabling them to understand, control, and manage their processes more effectively. Japanese managers understand their product, process, and employees. Japanese product development engineers generally have a broader knowledge of manufacturing requirements than do their American counterparts, since Japanese engineers usually start their careers in manufacturing. Japanese firms emphasize employee involvement, a factor which broadens the factory worker's responsibilities and dramatically reduces the need for the indirect professionals who are so apparent in U.S. organizations. Japanese management structure is "flat" with knowledgeable, experienced, executives who know the product development and manufacturing processes and place the highest priority on developing a business that will have long-term success rather than just quarterly profits. If that is not enough, the Japanese management invests in quality programs of continuing improvement in both product and process which guarantee that they just continue to get better!

Responding to the Challenge

Some U.S. companies are responding to the challenge of the Japanese competition. Those who responded early are the ones who now compete directly with the Japanese. Operations in these responding companies are not "business as usual;" in some cases, radical changes to the corporate organization have been required (e.g., in the case of Xerox). In all cases, the technical leadership of the project was a conscious, focused effort to improve product development and manufacturing. This type of technical leadership must be enhanced if U.S. industries are to regain leadership in product development.

What can we do about this situation, (especially if we are not in the position to reorganize the whole company)? All of us who work in compartmentalized, specialized organizations recognize that it is more comfortable to maintain the status quo than to initiate change in the organization. In many cases, as individuals, our current positions and future career opportunities are enhanced by the specialized organizational structure that is in place, so why should we rock the boat? Most of us believe that organizational structure is headquarter's function, certainly not ours! However, it is probable that if no corrective action is taken, a company can fail in the manufacturing business in fewer than five years. In addition, the solution that headquarters have used in many cases is to shut down U.S. manufacturing operations and acquire products from overseas. But manufacturing operations are not the only ones shutting down; many large companies are disbanding their own development laboratories (actually, this would be described as "consolidation" in the press release) and procuring the complete product line from overseas. In this process, career opportunities evaporate rapidly as the organization phases down.

Finding Solutions

For those near retirement, what fun is there in spending the last five-ten years of your career "turning out the lights?" It is infinitely more important and satisfying to address the problem directly and to try to save your company or division than to stay and quietly watch it die. What are the alternatives?

You can provide leadership in identifying the problems in your organization, some of which were illustrated in Figure 1. Find the "incentive" systems within your organization that are causing people to make the wrong product quality decisions and eliminate those systems. Initiate cooperation among the conflicting functions. If you are a manager, change the mission statements so that the missions do not conflict. Change the organization to improve its ability to develop new, innovative products.

The most effective organizational change in my study of over 20 cases of superior product development is the use of a single development/manufacturing team for new product development.[3] Small integrated teams which have members with broad skills from engineering, manufacturing, marketing, service,

2. L. L. Hadden, "Product Development at Xerox: Meeting the Competitive Challenge" (Westley Chapel, Florida: Copying and Duplicating Industry Conference, February 10-12, 1986).
3. Xerox Corporation, "Product Delivery Process Overview" (PDP, 1988).

procurement, finance, etc. have the mission to develop the product from inception through the first six months of manufacturing. In the Xerox organization, the leader of this team has total responsibility for the delivery of the product, the design teams, the model shop, and the pilot plant for the new product. He has complete authority to modify the schedule and to make "go/no-go decisions." A story of the changes of the Xerox Corporation is told in the book, *Xerox, The American Samurai*.[4] Another book, *Blue Magic*,[5] tells the fascinating story of the development of the IBM Personal Computer and the first IBM Independent Business Unit organization.

Meeting Obstacles

In many cases, you will not be able to initiate a single team approach from your position. If you cannot change the organizational structure, what can you do? One alternative is to realize that there are improvements in the operation of the organization that result in remarkable enhancements in product quality, product development time, and reduced cost of operation...more than you ever thought possible! These are the major quality programs.

Ideas for changing the organizational system to achieve improved quality and productivity are available from the Xerox example and from the programs and writings of W. Edwards Deming, Phillip Crosby, John Gardner (*Self Renewal*)[6] and the programs of the Institute for Productivity Through Quality at the UTK Management Development Center. These new business systems encourage value to customers, continuous improvement of development and manufacturing processes, continual skill improvement of employees, and long-term stability of the company. These sources are also beginning to investigate accounting systems that will protect the fragile state of an embryonic product and find adequate resources and time to develop it.

Having personally participated in a major industry quality program in my own company, I can state that the product quality improvements over a two-year period were exceeded beyond all expectations. The product warranty performance improvement that was projected to be 17 percent actually improved 49 percent. The machine performance that previously had been third in the industry improved to equal the best in the industry after completion of the two-year quality program. A major quality program can turn an organization around.

Obviously, there is a serious new product development problem in the U.S. Since it is through successful new product introduction that the "economic pie gets larger" for our country, this subject deserves the attention of the best minds in the business and technical communities. Only with enormous individual efforts, intense cooperation within the business and technical communities, and major changes in our business systems, can we bring competitive U.S. products into the world marketplace.■

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4. Gary Jacobson and John Hillkirk, *Xerox, The American Samurai* (New York: Macmillan Publishing Company, 1986).
5. James Chposky and Ted Leonsis, *Blue Magic* (New York, Oxford: Facts on File Publications, 1988).
6. John W. Gardner, *Self Renewal, The Individual and the Innovative Society* (New York: Harper & Row, 1965).

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THE IMPORTANCE OF QUALITY AND CONTINUOUS IMPROVEMENT IN LOGISTICS CUSTOMER SERVICE

by James H. Foggin

It is not enough for a firm's management simply to make a better product. Much more must be done to market it effectively. Since a buyer weighs a number of elements related to the product in terms of how well they each meet his needs, marketing managers must strike a delicate balance between these elements in creating an ideal total package.

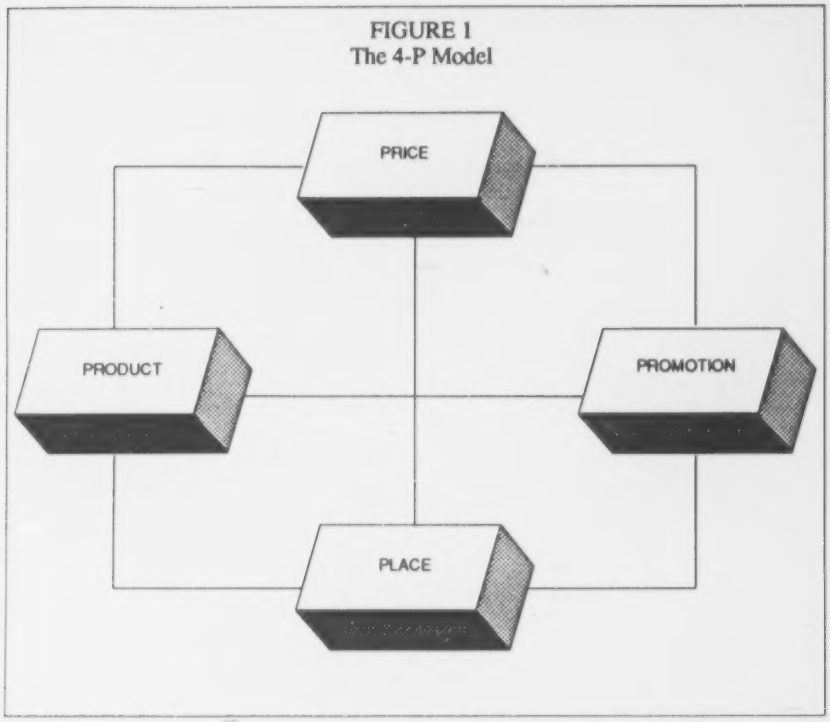
This article will discuss ways in which one of the important elements of marketing--logistics service--can be used most effectively to assist in marketing the firm's product. First, logistics has a critical role to play in the marketing process. Second, logistics adds value to the product or service offered by the firm if the service is of sufficient quality. Third, firms are coming to recognize how logistics can give their organizations a competitive edge in the market place. Finally, there is a growing realization that firms must continually improve their logistics services.

Competition and the 4-P Model

A basic principle of marketing is that Product, Price, Promotion and Place make up the mix of elements that a customer considers in a purchase situation. This 4-P model, illustrated in Figure 1, describes how these four elements relate to the total package of what a company sells. Although the model is extremely simple, it is very useful for reminding all executives what must be done to market a product.

The 4-P model explains in general terms the elements that enter into a buyer's purchasing decisions. A buyer purchases according to how he perceives the totality of the mix meets his needs. When all firms in an industry seem to offer the same thing in each of the four elements, then a buyer will not care who he buys from. Firms compete for the attention of buyers by being different. According to Porter, a leading strategist, "a firm differentiates itself from its competitors if it can be unique at

FIGURE 1
The 4-P Model



something that is valuable to buyers."[1] The buyer attaches value to part or all of each of the four elements. How each firm addresses that value will determine its success.

In an industry where three of the elements are equal among the competing firms, the seller that has a superior fourth element, known to his customers and perceived by them to have value, can be expected to sell more of its product. The simplest example would be the case where price, promotion, and delivery service are the same. In this instance, the firm which offers the best products will sell more of its products. By the same token, in an industry with a homogeneous product, where promotion is of little importance, and where price tends to be rigidly maintained, the company that is able to perform its delivery service best can expect to sell more of its product than the competition.

More complicated is the case where all or some of the four elements are different. Then, the buyer weighs each factor, either objectively or intuitively, and makes his purchase based on how well the overall package meets his needs. Consequently, marketing executives must make a very careful determination of what mix of factors to offer.

Historically, logistics (of which physical distribution is a part) was not considered to be very important. LaLonde described the mentality of many general managers in his 1978 statement when he paraphrased their point of view: "If you're smart enough to make it, aggressive enough to sell it--then any dummy can get it there."[2]

However, this point of view is no longer valid. General management has come to realize the importance of the role of logistics in the market place.

Logistics and the 4-P Model

Stock and Lambert[3] have extended the 4-P model with a useful expansion of the fourth P--Place. Figure 2 is an illustration of their expanded model. They equate Place to the role of logistics in providing delivery service, hereafter called Logistics Service. Viewed in this way, the inter-relationship of marketing and logistics through Place takes on a much clearer meaning.

Viewed from the marketing portion of the model, Place describes the totality of the logistics function and is composed of the logistics activities of the firm. Place includes transportation, warehousing, order placement and information systems, production lot quantity determination, and inventory management. Each of these factors represents a cost center, and together represent the total cost of logistics.

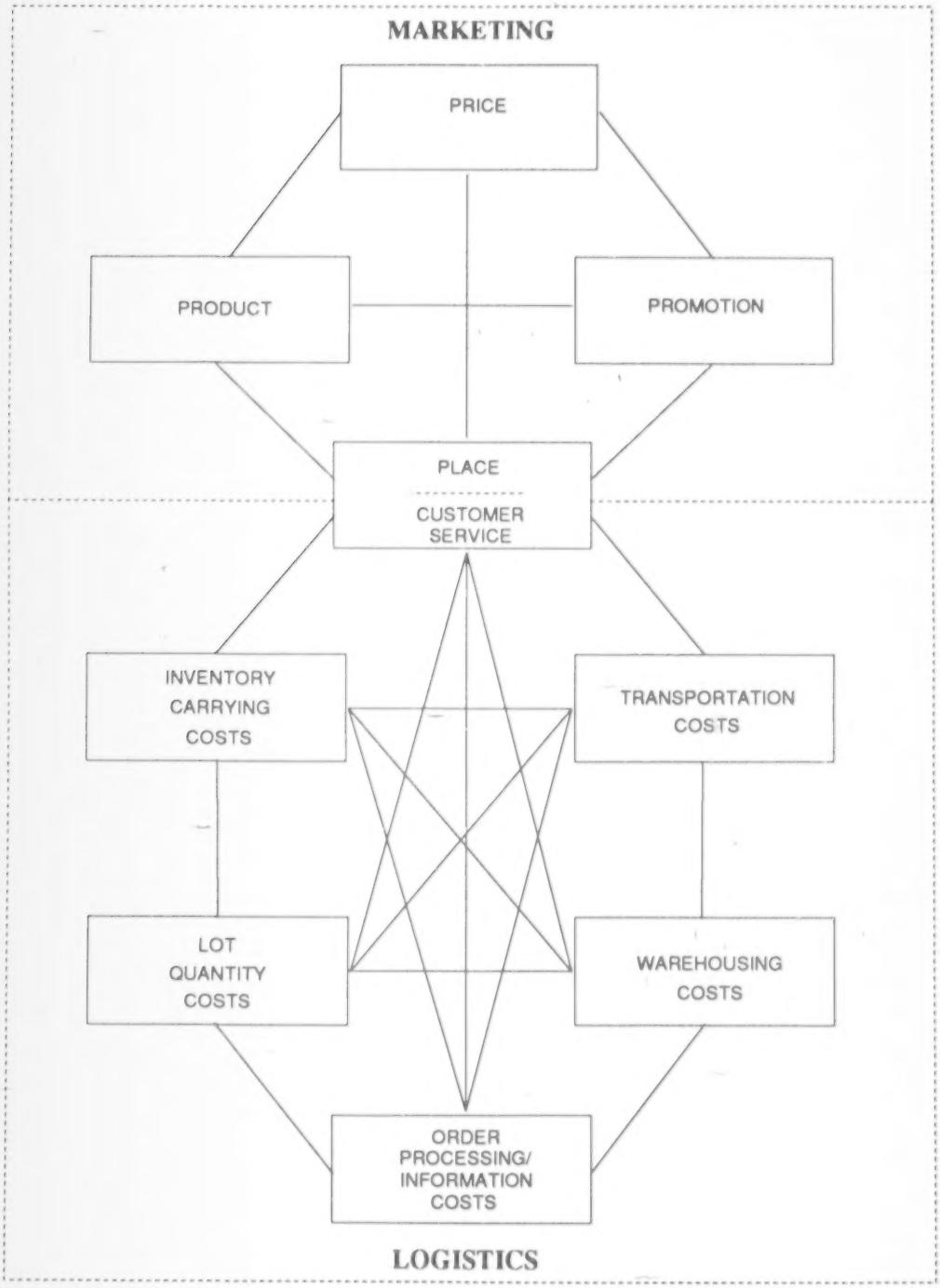
Viewed from the logistics portion of the model, Place is recognized as more than just a cost. It can also be seen as a source of revenue since it contributes to the ability of the firm to sell its products. Conversely, Place can be thought of as an opportunity cost resulting from a failure to perform an adequate level of service. A deterioration in any one of the several logistics components (e.g., transportation) may reduce service and thereby increase the cost of lost sales. Improvements in the logistics components, on the other hand, will improve service. The costs of all of the logistics activities are traded off against one another and against the opportunity cost of customer service failures to determine the profit potential of the logistics function.

Another use of the model is to show how conflict may arise between the two functions. If logistics executives place too much emphasis on cost minimization, or if marketing executives place too much emphasis on revenues without considering costs, the efforts of either group to effect a change may be viewed by the other with anxiety.

This expanded model is also very useful in providing insight into logistics service strategies which a company can use to obtain a competitive advantage. Furthermore, it can be used to explain how logistics can add value in excess of cost by following different strategies to meet the customers' needs.

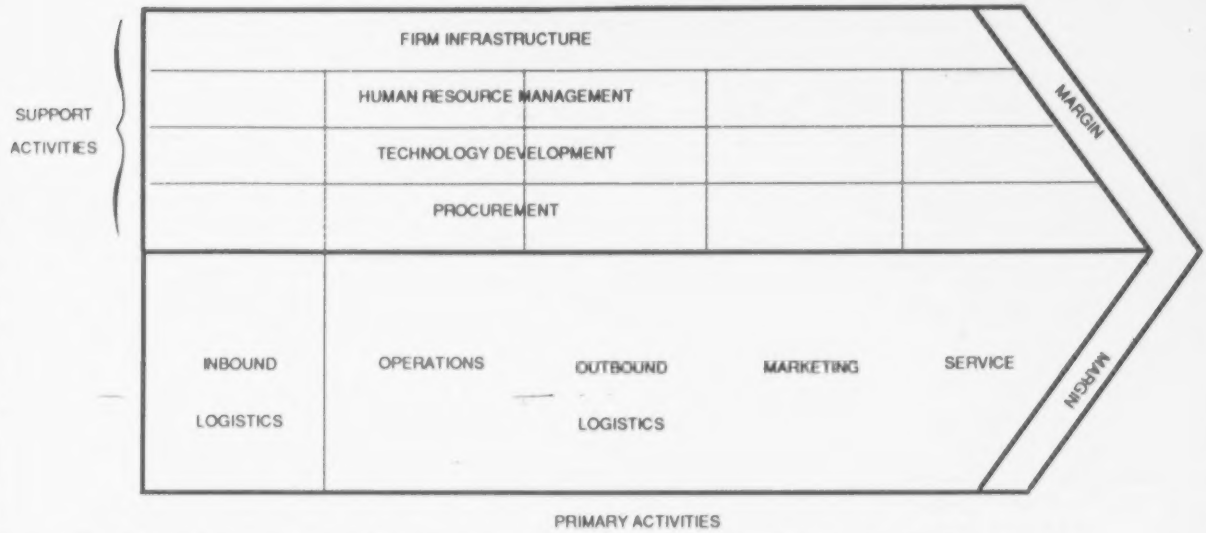
1. Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitor* (New York: The Free Press, 1980), 119.
2. Bernard J. LaLonde, quoted in James C. Johnson and Donald F. Wood, *Contemporary Physical Distribution and Logistics*, 3rd ed. (New York: McMillan Publishing Company, 1986), 3.
3. James Stock and Douglas A. Lambert, *Strategic Logistics Management* (Homewood, IL: Richard D. Irwin, Inc., 1987), 42.

FIGURE 2
The Lambert and Stock Expanded 4-P Model



Source: James Stock and Douglas A. Lambert, *Strategic Logistics Management* (Homewood, IL: Richard D. Irwin, Inc., 1987), 42.

FIGURE 3
Porter's Value Chain Model



Source: Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York: The Free Press, 1980), 88-89.

Value and Logistics Function

Porter defines "value" as the amount buyers are willing to pay for what a firm provides them. It is measured by total revenue.[4] Value and cost are not the same thing. An item gains value when something is done that makes the customer willing to pay more for it. Value is lost when something is done, or not done, that decreases the amount a customer is willing to pay for it. Cost is incurred separately from value. For example, an item sitting idly in inventory incurs a carrying cost (e.g., interest on the money used to acquire it). The value on the item may or may not change by its being in inventory. Its value may increase because it is there when the customer demands it, or if it is being held on the customer's account.

Porter also states that simply looking at value added to a product does not adequately explain how a firm achieves differentiation. He develops a model around the flow of goods within a firm called the value chain. The value chain displays total value, and includes margin, which is the difference between value and cost. This chain, illustrated in Figure 3, consists of a number of primary activities in sequence, and a number of support activities. The several primary activities are inbound logistics (what is also called materials management), operations, outbound logistics, marketing and sales, and service.[5] Simply looking at value added is not sufficient to explain differentiation. One must look at the buyer's value chain and establish linkages to it. From a logistics perspective, the obvious linkage is between the seller's outbound logistics activity and the buyer's inbound logistics activity. By looking at the buyer's value chain, the seller may be able to determine what has value to the buyer and design his logistics system to provide the service required. While the model is described within the context of a channel of industrial firms, the analysis is applicable to sales to consumers as well.

Logistics can add value to a product. The simplest way of illustrating this is to consider the example of a buyer having the choice of purchasing the item FOB Origin, or FOB Delivered. The difference in what the customer will pay FOB Origin or Delivered is the value added by the logistics service. To the extent that the customer will pay more for excellent delivery service over marginal service, still more value is added.

What adds value in logistics? Logistics managers have long recognized what are called the "rights" of the customer. The customer should receive delivery of:

- the right product
- at the right place
- at the right time
- in the right condition.

There is a fifth "right"--the right price. The expanded 4-P model explains how this factor relates to the other four. These rights can be used to explain the customer's viewpoint of value. Failure to adequately perform to the minimum described in the statement will cause a loss in value of the product. For example, consider the case of a manufacturing firm that uses a product as a component part in an item it makes. The buyer is willing to pay a certain amount for the item because he/she expects it to be available for use in

4. Porter, p. 38.
5. Porter, pp. 38-61.

a finished product which can be sold for some greater amount.

Failure to deliver the correct component means that production cannot take place at all until the component can be reordered. The customer does not have a product for his customers, so the value of his own product is zero.

Failure to deliver the component to the right place may reduce the value of the product marginally or totally. If the component is delivered to the wrong delivery dock in the correct plant, the receiver must expend some effort to move it to the correct place. Cost is added. If it goes to the wrong plant, it will require a re-shipment. Cost is added here as well. But if a delay also results, then value will be lost.

If the component is delivered too early, it must be stored, adding cost. If late, production will be delayed. The value of the finished component will be reduced by any losses in sales the buyer may incur as a result of the delay, distributed over each item. If the components are not all delivered in the right condition, the size of the customer's production run will be reduced. There may be no effect on the value of the customer's product if he can re-schedule production and reorder to replace the damaged items, but his costs will increase. If he cannot reschedule, he may incur a loss equal to the losses in sales distributed over the total size of the production run.

The importance of the logistics service in adding value is clearly illustrated by these examples. Logistics adds value when it is properly performed, and reduces it or eliminates it entirely from the customer's point of view if it is not properly performed.

The Growing Importance of Logistics

Many companies are beginning to recognize the importance of Logistics Service (Place) in gaining for them a competitive edge. This has been a slow process, however, and is not yet completed. For example, in one of the earliest textbooks on distribution management, logistics customer service was equated to ensuring that the firm had sufficient stock on hand to fill customers' orders. The entire discussion consisted of a few paragraphs. More recent studies have looked at how Logistics Service relates to the other three "P's" in the model. Some of the major findings over the years are as follows.

In a 1978 study, some 16 purchasing evaluation criteria were ranked by purchasing managers. In situations where a purchase was routine--for everything from component parts to operating supplies--the reliability of delivery was ranked above price as most important.[6]

The definition of quality as conformance to customer requirements is used as a measurement by many companies. In this scenario, the customer himself essentially is defining quality, and the provider must then conform to the customer's definition.

A study in 1985 reported that "product and physical distribution customer service factors contributed to share of business allocated to manufacturers" in a specific industry which the author surveyed. Price and promotion factors were found to be less important.[7]

Many firms are using logistics customer service proactively, as a way of differentiating them from competitors in the same industry. The authors also stated that "*[t]he evidence suggests that the customer service component of the marketing mix will become more important in the intermediate term future(1987-1990) as compared with product, price and promotion.*" [Italics added.][8]

The authors of this same study reported that findings of their survey "suggest strong pressure from customers, competitors, and new technology to maintain higher standards of customer service. The expectations of the customer is higher and the capability of the customer to monitor performance on a real-time basis is steadily increasing."[9]

These several studies indicate that Place is a very important factor in the buyer's decision. A caveat is necessary at this point, however. It must be stated that industries vary in practices, and therefore one might expect to find that the relative importance will vary from one industry to another. In some industries it will be a key variable, while in others, it will not be.

What is Quality in Distribution?

There are many ways of defining quality. One might be that "Quality is in the eyes of the beholder." Unfortunately, viewed this way, no common measure of quality can be made, and little practical use of the definition is possible.

The most widely accepted definition of quality today is that of the quality guru, Philip Crosby, in his popular book, Quality is Free.[10] His definition is simple and easy to remember: "Quality is conformance to requirements." By this definition a Volkswagen which has been made to the requirements specified for the manufacture of a Volkswagen has quality. Conversely, a Mercedes which does not meet all the requirements of a Mercedes lacks some measure of quality. In other words, the definition does not deal with aesthetic issues, merely the requirements set forth for the product. However, the definition lacks something. It lacks that something which makes the well-made Mercedes more appealing to some than the well-made Volkswagen. It lacks a customer orientation. Consequently, the definition "Quality is confor-

6. Philip D. White, *Decision Making in the Purchasing Process: A Report* (AMA Management Briefing at AMACOM, a division of the American Management Association, 1978), 20-47.
7. Jay U. Sterling, "Integrating Customer Service and Marketing Strategies in a Channel of Distribution: An Empirical Study," (unpublished Ph.D. dissertation, Michigan State University, 1985), 261-72.
8. Bernard J. LaLonde, Martha C. Cooper and Thomas G. Noordewier, "Customer Service: A Management Perspective," *Transportation Executive Update*, (July/August 1988): 18-22.
9. Bernard J. LaLonde, Martha C. Cooper, and Thomas G. Noordewier, *Customer Service: A Management Perspective* (Chicago: The Council of Logistics Management, 1988), 7.
10. Philip B. Crosby, *Quality is Free* (New York: New American Library, 1979), 15.

mance to customer requirements" is a better definition, and is in fact used by a number of companies today.

Viewed in this manner, the "eyes of the beholder" are taken into account, because the customer defines quality as he/she sees it, and it is also measurable by the provider of the product or service. What is apparent in this viewpoint is that the customer is defining quality, and the provider must conform to the customer's definition.

Once this is recognized, what follows is the recognition that in order to provide the quality that the customer wants, *it is imperative that the provider find out what the customer wants.* Marketing managers have long recognized that not all customers want the same product. Look in any new car lot and see the number of different models, and this difference is immediately apparent. Nor is there any reason to suspect that all customers served by a company desire the same kind of logistics service. Consequently, the firm must begin by surveying its customers to determine what their logistics needs are, and be willing to separate customers into different groups if necessary, with the groups being based upon the logistics requirements of the customers.

This is not to say that we have no idea what customers want in the way of logistics service. The four "rights" mentioned above, for example, give us a hint of customer requirements.

A number of studies have been conducted in recent years by various authors on determining service requirements for logistics customer service. Some are generic in form and describe what the "average" customer considers to be good service. White's[11] study of purchasing managers was one such, in which he found that reliability of delivery was an important factor in the buyer's decision. Others are specific to an industry, and describe what is demanded by specific customers.

Perrault and Russ[12] found that "average delivery time" and "delivery time variability" were the two most important variables in 1976. A study by LaLonde and Zinzer,[13] and a later report on the subject by LaLonde[14] suggest that "product availability" is the most important customer service requirement, while order cycle time is the second most important.

In 1981, the Grocery Manufacturers Association (GMA) conducted a study of 70 major wholesale and retail grocers in the U.S. They found that "delivery availability on the day requested" was the most important service requested.[15] Most recently, a 1989 study conducted by *Traffic Management* magazine on transportation quality reported that a majority of customers define quality as "on-time pickup and delivery." An interesting item also mentioned is the fact that 63 percent of the respondents stated that they will pay more for higher quality service.[16]

What these several studies seem to indicate is that dependability of delivery seems to be important to most customers. A very interesting aside is that very little consistency exists as to what the next most important elements are.

The Need to Continuously Improve

It is very tempting for a firm to make a one-time major improvement to its service and then wait for the next opportunity (or funding) to make another. For example, in the last decade, a number of firms have installed computerized order processing systems at great expense. This resulted in giving the selling firm more planning time in the order cycle--for a while. But as competitors acquired similar systems, order cycle times demanded by customers dropped. The initial innovators were forced to look around for something different to do.

These kinds of improvements, improvements in the design of the process, are necessary. But other kinds of improvements which provide better conformance in the system are more meaningful in the long run.

In an earlier paper, the author demonstrated the relationship of costs and revenues to quality improvements in both static and dynamic situations.[17] Figures 4, 5 and 6 illustrate how costs react when a firm changes the quality of a product or service. The vertical axis shown is the cost axis. It is set up in terms of cost per unit of a good. The horizontal axis is a continuum of quality, where quality is defined as absence of variation in some critical measurement. This definition is "conformance to customer requirements" carried beyond the static situation. At the origin, there is a great deal of variation. At the end of the axis, there is very little variation in the product.

Three major cost categories are shown in the chart. The first, shown as a curve increasing to the right, is the cost of conformance. Conformance costs include training, inspection, and the like. The costs of nonconformance are illustrated as a curve decreasing at a decreasing rate as it moves to the right along the axis. Non-conformance costs include costs of product failure when discovered prior to delivery to the customer and costs of warranties when discovered by the customer. The third cost shown is called an opportunity cost. Opportunity costs are "the costs associated with customers who are unhappy with a product or service which has been offered to them, or which has failed them before. They may not complain or file claims for warranties. What they will do is simply cancel the order, buy the item somewhere else, insist on a lower price, or start using other suppliers. Opportunity costs are also referred to as "lost sales" or "lost customer" costs--terms which have a more forceful connotation about them."[18]

Figure 4 illustrates what happens to a firm which innovates by improving quality in the short run. As quality improves (i.e., as variation is reduced) conformance costs increase, but opportunity

11. White, pp. 20-47.
12. William D. Perrault, Jr., and Frederick A. Russ, "Physical Distribution Service in Industrial Purchase Decisions," *Journal of Marketing* 40 (April 1976): 8.
13. Bernard J. LaLonde and Paul H. Zinzer, *Customer Service: Meaning and Measurement* (Chicago: National Council of Physical Distribution Management, 1976), 171.
14. Bernard J. LaLonde, "Customer Service," *Distribution Handbook* (New York: The Free Press, 1985), 243.
15. Grocery Manufacturers Association, "*Customer Service Study*," 1981.
16. "What is Transportation Quality?" *Traffic Management* 28 (May 1989): 38-41.
17. James H. Foggin, "The Economics of Continuous Improvements," (MDC Working Paper No. 3, College of Business Administration, The University of Tennessee, Knoxville, 1989).
18. Foggin, p. 10.

costs and non-conformance costs decrease. If the firm is to the left of the minimum point on the total cost curve, it will be better off by improving than it was before, provided that no one else in the industry reacts to the change. If competitors do react, the opportunity costs curve moves to the right, and total cost increases. This is illustrated in Figure 5 where the original curves are shown as dashed curves, and the current curves are shown as solid curves.

In a dynamic market, two forces affect the cost curves shown. One force is internal to the firm. Figure 6 illustrates one thing that happens to firms in a dynamic market over time. In this situation, learning how to provide quality takes place, so that the same level of quality can be provided by the firm at a lower cost.[19] Consequently, the low point on the total cost curve shifts to the left, and the firm finds it is better off providing more quality.

The second driving force is external to the firm. In today's market, with the emphasis (real or otherwise) on quality in all aspects of the firms endeavors, other firms will improve the quality of their logistics service, and customers will be less willing to accept insufficient quality. The opportunity cost curve will shift to the right in the same manner as was illustrated in Figure 5. The firm is driven to improve its quality.

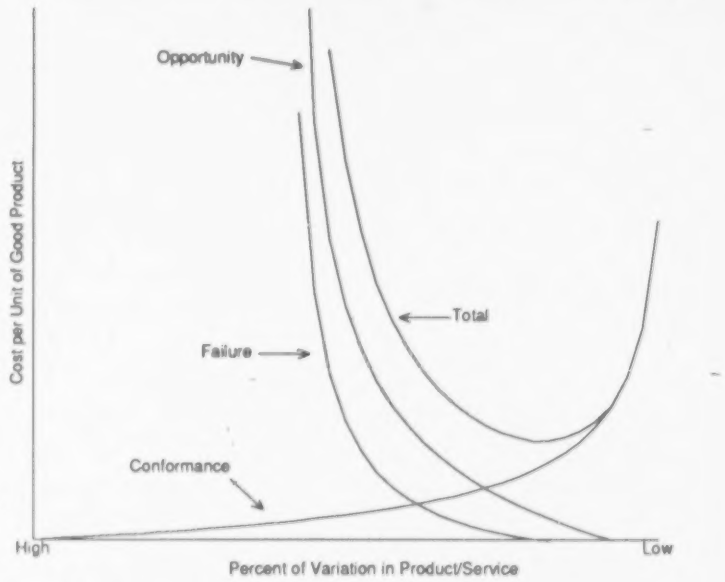
These two forces, taken together, allow and demand the firm to improve quality on a continuous basis.

Conclusion

Without question, logistics service can be an effective marketing tool in a competitive environment. Efficiently and effectively performed logistics adds value to the firm's products or services. In a number of industries and markets, it may offer the selling firm the competitive edge. Firms need to learn how logistics can be used effectively.

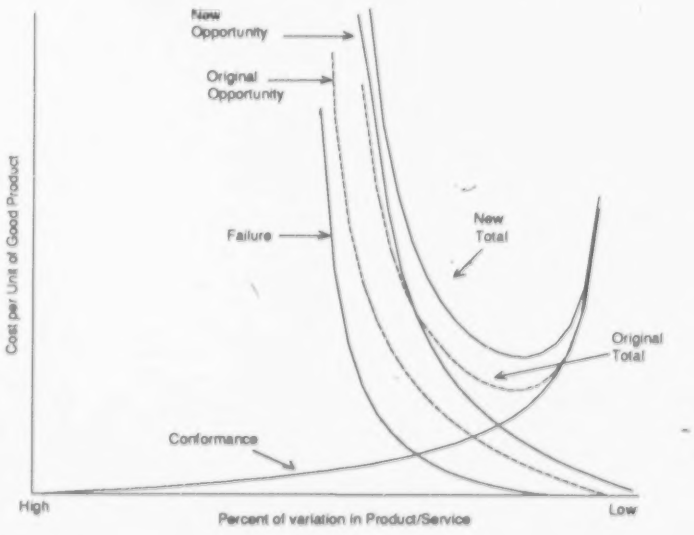
Firms seeking to effectively compete with logistics should make continuous improvements in the conformance quality of their logistics systems. This will, in many cases, be a very effective form of competitive strategy. There are several ways this might be done:

FIGURE 4
The Static Model Showing the Relation of Cost and Revenue to Quality



Source: James H. Foggin, "The Economics of Continuous Improvements," (MDC Working Paper No. 3, College of Business Administration, The University of Tennessee, Knoxville, 1989).

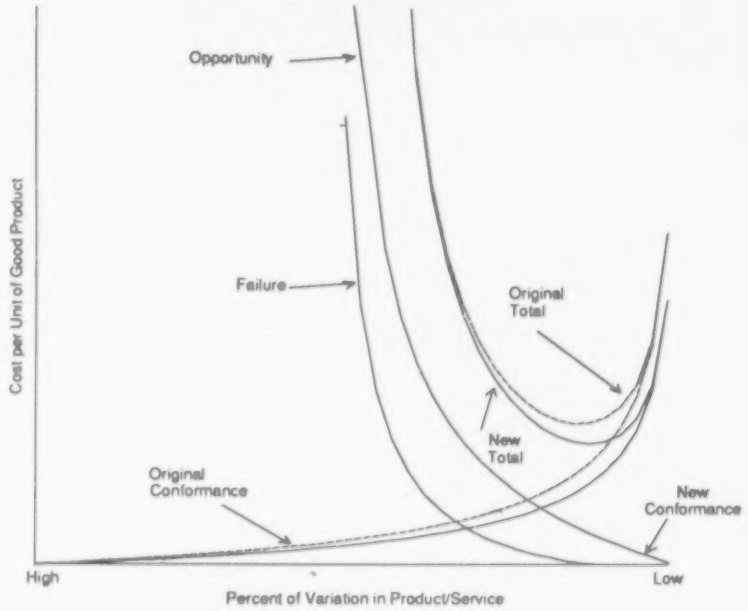
FIGURE 5
The Model Showing the Impact of Competitive Moves in Both the Static and Dynamic Situation



Note: Dashed lines show superceded cost curves.
Source: James H. Foggin, "The Economics of Continuous Improvements," (MDC Working Paper No. 3, College of Business Administration, The University of Tennessee, Knoxville, 1989).

19. Charles H. Fine, "Quality Improvement and Learning in Productive Systems," *Management Science* 32:10 (October 1986): 1301-1315.

FIGURE 6
The Dynamic Model Showing the Relation of Conformance Cost and Revenue to Quality



Note: Dashed lines show superceded cost curves.
Source: James h. Foggin, "The Economics of Continuous Improvements," (MDC Working Paper No. 3, College of Business Administration, The University of Tennessee, Knoxville, 1989).

- Begin the quality improvement process by learning what the customer wants. Get close to the customer. Don't count on experience, or on industry practices to find out what customer requirements are.

- Of primary importance is the determination of the importance of Place relative to Price, Product and Promotion in the customer's eyes. Once this is known, and if it is important, then the key variables that make up Logistics Service must be ascertained.

- Try improvement before scrapping an existing system. Avoid the temptation to redesign a system that does not seem to be working as well as it should, before attempting to bring it into conformance. Poor design may not be the problem. It is possible that the system is not being effectively managed or controlled.

- Concentrate on improving those parts of the logistics process that contribute most to providing consistency to the elements that the customer wants most.

- Learn to use the quality tools that the Japanese used so effectively to control quality of conformance. These techniques are generally labeled Statistical Process Control Techniques, and are those advocated by W. Edwards Deming.[20]

Under these conditions, a firm should be able to increase market share at the expense of competitors, all the while leaving the competition wondering what has happened. ■

20. See, for example, W. Edwards Deming, *Quality, Productivity and Competitive Position* (Cambridge, MA: MIT, Center for Engineering Study, 1982); see also James H. Foggin, "Improving Motor Carrier Productivity with Statistical Process Control Techniques," *Transportation Journal* 24 (Fall 1984): 58-74.

Mary D. Dolan
Manager of Manufacturing Systems
Campbell Soup Company

TEAM PLAYING: THE SELECT SUPPLIER PROGRAM

by Mary D. Dolan

World-class recognition can be achieved only by involving all players in the total process. In the business of Campbell Soup Company, the process starts in the agricultural field with growing the basic commodities for food processing and ends with the consumption of the finished product by our consumers. Any quality improvement effort must be applied to a number of areas: the preprocessing arena, the manufacturing or assembly of the product itself, the distribution of goods or services to the end user, and the marketing and administrative support within the business. The actual manufacturing time of our products is relatively small in proportion to the total time within the cycle.

In its quest for a Total Systems Approach to Quality Management, Campbell recognized the need for strategic linkage with the suppliers of goods and services that impacts the manufacturability and distribution of its products. Our principals of operation include several statements that support the company's quality efforts:

Our first responsibility is to the people who buy and use our products and services. We are dedicated to providing them with superior quality and value.

Our suppliers contribute significantly to the quality and value that goes into our products and services. We must be selective in choosing outstanding suppliers--and treat them with respect, courtesy and fairness.

Select Supplier Program

Several years ago, Campbell's senior management held regional orientation meetings around the country, with over 1400 suppliers of ingredients, packaging, equipment, and distribution services. At these meetings, management of our supplier companies was urged

to join in a strong partnership with Campbell Soup Company. The philosophy was that the benefits accrued from this partnership would not only enhance the price/value relationship of Campbell products, but the resulting productivity gains would also be shared in the supplier's own business with the institution of quality management concepts. Initially, the reaction was mixed, but over time and through a learning curve, most suppliers recognized that such an arrangement made good business sense. Thus, the Select Supplier Program was born at Campbell Soup Company.

Spearheaded by the corporate Procurement Department, the Select Supplier Program establishes a strong partnership with our suppliers of ingredients, packaging, miscellaneous materials, equipment, and distribution services. Benefits accrued from this partnership improve the quality of products and/or service and increase the productivity for *both* Campbell and the supplier. The commitment with our supplier and his/her business is supported by offering training and education to supplier employees in the tools and techniques involved in an ongoing quality and productivity improvement process.

The Campbell philosophy is that you only get out of a process what you put in. Controlling the factors *before* the products enter the assembly or manufacturing stream is less costly than inspecting out and reworking defects. Our suppliers must statistically demonstrate that the material or services provided consistently meet an established level of quality, that they are delivered within a just-in-time (JIT) scenario, and that improvement in quality and service is strived for continually. All criteria must be met while still maintaining a favorable price/value relationship.

The Select Supplier Program at Campbell provides for more open communication in the supplier/customer relationship, which is so often lacking in business today. Problem-solving for process improvement is shared between supplier and Campbell teams. This procedure "fixes," rather than "repairs," a process contributing to nonconformities in either the supplier plant or Campbell's using plant.

The ultimate objective is for the supplier to concentrate on process improvements which will provide consistent quality material to Campbell for use in the production stream without the need for inspection.

Levels of Requirements

In the Select Supplier Program, there are three levels of requirements--qualified, preferred, and select. The evaluation process within each level is specific and comprehensive. Within each level, the supplier completes a self-assessment questionnaire to determine degrees of commitment, involvement, and support of Campbell's Select Supplier Program. The responses are subsequently verified by Campbell representatives.

1. *Qualified Supplier*. (Initial Phase) The criteria in this stage address such issues as technical capabilities, financial health, compliance with regulatory agencies, capacities, and, most importantly, quality mind-set and willingness to participate.

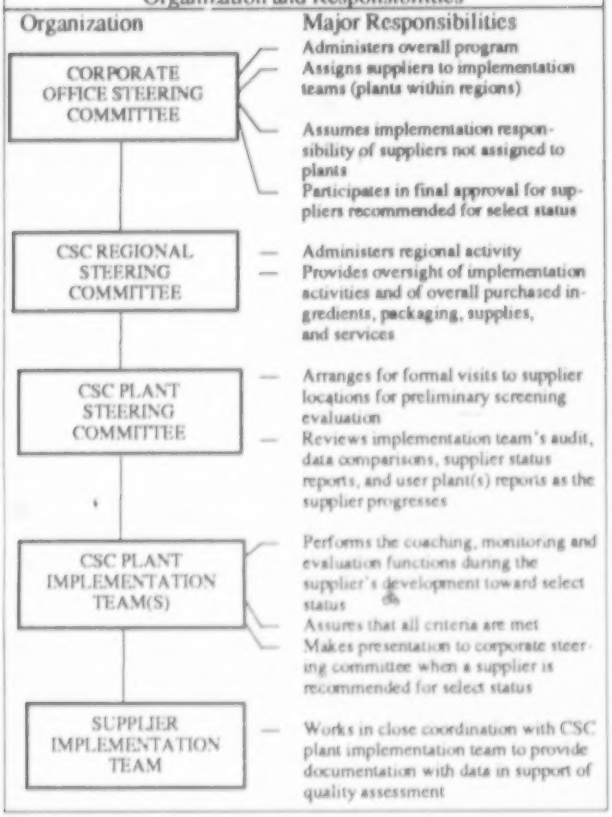
2. *Preferred Supplier* (Intermediate Phase). After substantiation that all Qualified criteria have been met, additional data-based requirements are necessary to become a Preferred Supplier. The supplier company's top management commitment is demonstrated by establishing an implementation plan, training necessary for delegated individual(s) and timetables for accomplishment. In close coordination with Campbell, systems are identified (flow charted); critical quality attributes to be measured are agreed upon (specifications); statistical evidence of process capabilities are provided; and control charts are forwarded in support of material shipped. In addition to the data-based criteria necessary to become a Preferred Supplier, a just-in-time management system must also be developed.

3. *Select Supplier*. Having met all the requirements for the Preferred Supplier level, a supplier must demonstrate continual improvement over time through a reduction in variability which is statistically demonstrated in order to reach "select" status. Training programs are ongoing in support of management's commitment to the quality effort. Delivery performance must be consistently on time, without exceptions. The partnership between Campbell and the supplier is strengthened through achievement of productivity improvements and business expansion. Recognition is awarded to Select Suppliers in the form of a plaque, and an annual re-evaluation is made to substantiate conformance to requirements and ongoing improvement.

Management

The Select Supplier Program at Campbell is managed both locally and corporately with varying degrees of responsibility. (See Figure 1.) Certainly such a massive undertaking cannot be implemented by corporate headquarters. Individual supplier plants have been assigned to each plant for implementation of the Select Supplier Program, thus avoiding duplication of effort when more than one Campbell plant is supplied material from the same supplier. The using plant, being the primary customer, develops the rapport with the supplier, provides training in quality management and basic statistical process control, and substantiates the steps taken by the supplier in meeting the criteria for all three levels as they progress. There must also be concurrence by other using plants that a particular supplier consistently meets quality standards in material supplied to those operations. All of this activity is accomplished by an implementation team. In some instances, production workers from a Campbell plant have visited the supplying plant and worked with their production people to resolve variability issues. By the same token, teams from a supplier's plant have visited Campbell's plants to see first-hand how their material impacts Campbell's manufacturing system. The local plant steering committee supports and administers the local process, and the regional steering committee has ultimate responsibility for the implementation activities.

FIGURE 1
Campbell Soup Company Select Supplier Program
Organization and Responsibilities


Organization
Major Responsibilities
CORPORATE OFFICE STEERING COMMITTEE
Administers overall program
Assigns suppliers to implementation teams (plants within regions)
Assumes implementation responsibility of suppliers not assigned to plants
Participates in final approval for suppliers recommended for select status
CSC REGIONAL STEERING COMMITTEE
Administers regional activity
Provides oversight of implementation activities and of overall purchased ingredients, packaging, supplies, and services
CSC PLANT STEERING COMMITTEE
Arranges for formal visits to supplier locations for preliminary screening evaluation
Reviews implementation team's audit, data comparisons, supplier status reports, and user plant(s) reports as the supplier progresses
CSC PLANT IMPLEMENTATION TEAM(S)
Performs the coaching, monitoring and evaluation functions during the supplier's development toward select status
Assures that all criteria are met
Makes presentation to corporate steering committee when a supplier is recommended for select status
SUPPLIER IMPLEMENTATION TEAM
Works in close coordination with CSC plant implementation team to provide documentation with data in support of quality assessment

Once the implementation team of the using plant confirms that all requirements have been met by a supplier to attain Select Supplier status and has the agreement of all parties concerned (local and regional steering committees and other user plants), the team will make a presentation to the corporate office steering committee, which makes the ultimate determination as to whether Select Supplier status should be granted. All detail is supported by documented evidence. This corporate committee is comprised of cross-functional disciplines which can address all issues from statistics to technical capabilities. When the Select status is granted, arrangements are made to award the supplier with a recognition plaque.

Results and Benefits

Products and services received from a SELECT Supplier are of superior quality. The supplier has instituted a quality management process that concentrates on defect *prevention* rather than defect *detection*. This approach guarantees a quality product delivered just-in-time; reduces scrap, rework and inventory; increases productivity; and allows the supplier's customer--Campbell--to utilize materials without inspection. The benefits are not only fiscal to both the supplier and the customer, but, more importantly, the open communication between the two evolves into mutual respect and collaboration in a long-term relationship that perpetuates the continuous cycle of quality improvement in Campbell's quest to provide quality products to its consumers.

Suppliers

Internal Suppliers. Campbell has a number of ingredient plants which supply the manufacturing facilities with poultry, tomato paste, vegetables, pasta, and spices. Plants that manufacture cans are also considered internal suppliers to the soup plants. All self-manufactured ingredient and packaging locations must exhibit and document commitment to the Total Systems Approach and be evaluated for Select Supplier status. The evaluation includes all the criteria applicable to outside suppliers in addition to other corporate quality management directives and goals. The internal suppliers are assessed by a corporate implementation team comprised of quality assurance representatives, ingredient or packaging operations management, and other technical members as warranted. To date, one-third of our internal suppliers have achieved Select Supplier status; the remainder of this group expects to achieve this goal in the very near future.

Nondomestic Suppliers. Significant dollar purchases are made from nondomestic suppliers (out-of-season fruits and vegetables, fish, steel, etc.). These suppliers are the responsibility of the corporate steering committee in assessment for Select Supplier status. The implementation team is flexible, depending on the commodity, but maintains a core of corporate quality assurance and procurement evaluators. Just recently, Select Supplier status was awarded to two plants of a Japanese company which supply steel for our can-making operation. This represented the first award to a nondomestic supplier for Campbell.

Future Plans

Campbell's Select Supplier Program has been in existence for several years, but it wasn't until calendar year 1988 that several internal and external suppliers achieved SELECT status. At this point, only 3 percent of our major suppliers are SELECT, so there is quite a lot of work to do. The first annual re-evaluation will begin in the summer of 1989 to assure that our SELECT suppliers are continually improving their processes and services.

It is also recognized that some of our suppliers will never have the ability to reach SELECT status, but their quality-minded competitors will. The Select Supplier Program's process will ultimately result in not only reducing our supplier base, but in assuring that only superior materials and services will be supplied to Campbell Soup Company.

The quest for world-class status is a tedious and constant problem in today's competitive environment. Even though Campbell's Select Supplier Program is just one, but significant, increment in the Total Systems Approach to Quality Management, we are confident that it will cause a positive impact on the price/value relationship of our products. ■

Lyle Yorks
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Eastern Connecticut State University

ORGANIZATIONAL TRANSFORMATION IN TOTAL SYSTEMS QUALITY

by Lyle Yorks

As American industry moves into the 1990s, many companies seek to accomplish a fundamental change in how they do business. Since the globalization of the economy makes markets fiercely competitive, a movement toward adopting a Total Systems Quality concept of management has emerged. A select few of these companies will successfully accomplish what amounts to nothing less than what Edwards Deming describes as a transformation in how they manage, posed to become central players in the global economy of the 21st century.[1] Many others will fall short in this effort, repeating what has by now become a familiar pattern of grasping at fads while looking for an elusive quick fix.[2]

Characteristics of the Transformation Process

The concept of organizational transformation assumes a fundamental and pervasive change in a company as an organizational system, as opposed to the establishment of a small number of pilot sites in which elements of the Total Systems Quality approach have been implemented. From this perspective, success is measured when the various systems and principles comprising the approach no longer require special efforts to sustain them. Even if the advocates of the approach retire or

1. Edwards Deming, *Out of the Crisis* (Cambridge, MA: MIT, 1986), 18-96.
2. "Business Facts: What's In--And Out," *Business Week* (January 20, 1986): 52-61.

otherwise leave the organization, the systems and practices would remain. Displacing those systems would require as much energy and effort as was required to displace the conventional practices which preceded their implementation.

Integration of new procedures is a rigorous, but pragmatic, standard of success. Several organizations which have experienced varying degrees of success have provided us with the following observations about the characteristics of transformational organization change.

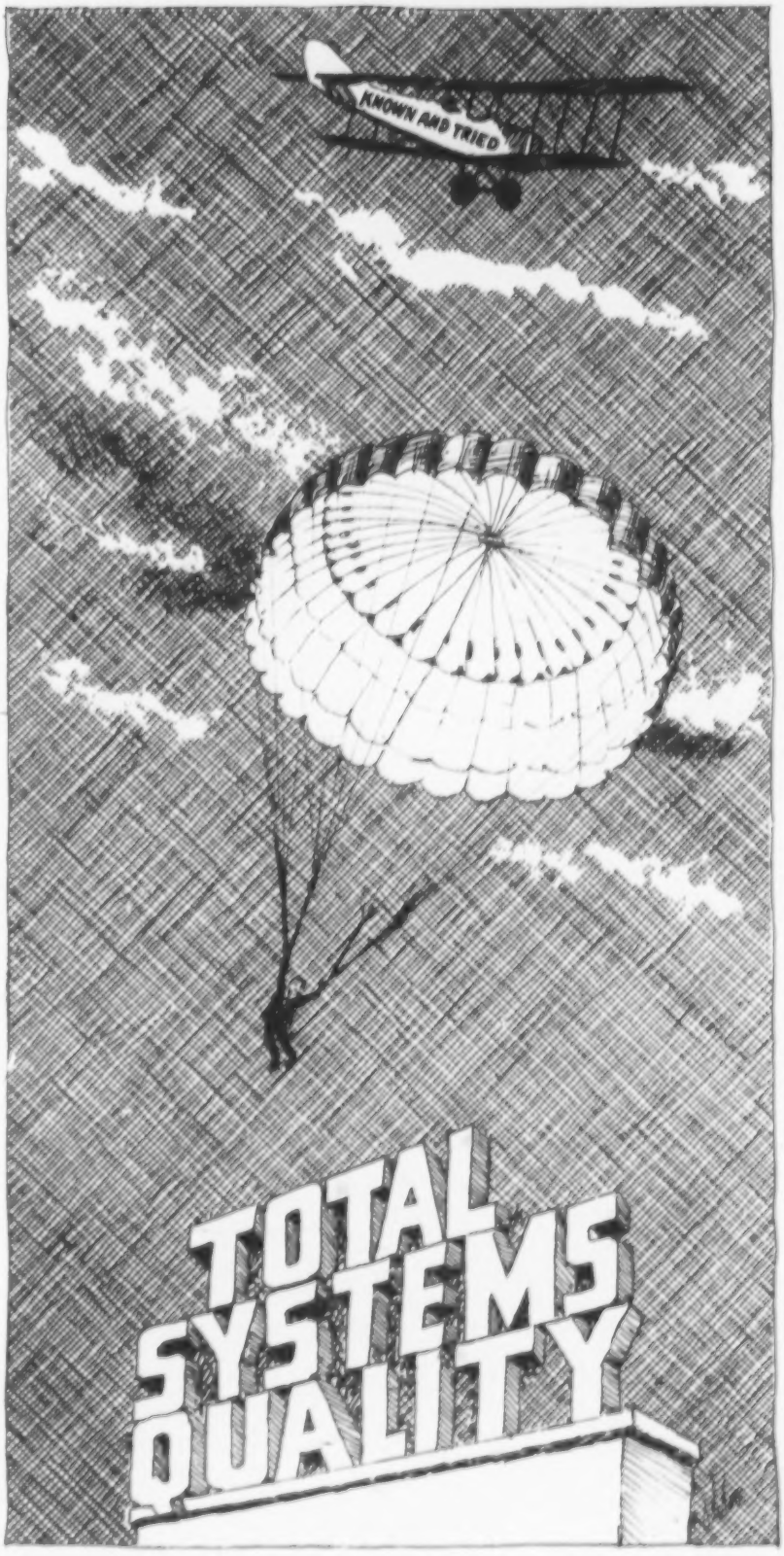
1. Transformational change in the workplace takes an extended period of time.

This notion, of course, is not unique to the Total Systems Quality concept. "Most innovations, in fact, diffuse at a surprisingly slow rate."[3] In our experience, however, management consistently underestimates how long and how difficult the pathways of transformational change can be.

In our research, one of the respondents (whose company is one which has successfully undergone substantial transformation) commented, "It takes seven years to get this stuff in." In another successful organization the president and chief executive officer observed that it took more than five years of concentrated effort to get to a plateau where he felt that key components of the approach were sufficiently institutionalized enough to be largely irreversible. We are not suggesting that it takes this long to see measurable progress in specific work sites; however, the process of institutionalizing the changes into the organization's culture does take a considerable amount of time. It is in those organizations where management is not prepared for a sustained campaign that management turns to other solutions, focus is lost and the transformation effort entropies.

2. The transformation process is nonlinear and irregular in nature.

Progress during this extended period of time seldom seems in proportion to the degree of effort which the advocates of



3. Everett Rogers, *Diffusion of Innovations* (Free Press, 1983), 7.

change expend. Rather, progress often occurs in spurts. Simultaneous efforts in different organizational units rarely proceed in parallel or symmetrical fashion.

In organizations we have studied, implementation of specific components of a Total Systems Quality approach such as Statistical Process Controls (SPC), Employee Involvement, or Training almost always takes longer than was initially expected. After a successful implementation in one part of the organization, there is a delay in beginning work elsewhere while advocates seek new opportunities. Contrary to popular expectation, success in one part of the organization does not generally lead to a rush to emulate the new approach. Rather, those threatened by the changes often delay, seizing on any emerging problem as a reason for avoiding further change. Some work sites which initially make rapid progress may grow complacent while late bloomers by-pass them.

In effect, an internal competitive political economy is created, with some work sites out pacing others. Eventually, those sites which fall too far behind may not survive over the long term as a process of economic selection takes place.

3. The transformation process is characterized by phases: progress must be periodically consolidated as the basis for the next initiative.

Our experience suggests that, typically, a company's management will become enthusiastic about some aspect of the Total Quality Concept either because an internal advocate has convinced management of its value or because a member of senior management is exposed to the concept and becomes excited by it. Either way, a small group of individuals is assigned to develop a program for implementation.

Also typically, the organization will become involved with one or two aspects of the Total Quality Concept, for example -- SPC and employee involvement groups. Between 12 to 24 months later, their efforts reach a critical point in the transformation process. Early successes will have already been won, but need to be sustained. It will be evident that more needs to be done, but it will also become evident that one or two techniques will not revolutionize the company's competitive position. Having gotten things started, senior management will direct its attention elsewhere. Perhaps management is disappointed that progress has not been more rapid or spectacular. It is precisely at this critical point that many organizations lose direction in the transformation process: staff get reassigned, and the effort becomes bureaucratized.

Those who are successful integrate what has been learned from the early experiences and revitalize the efforts. New components are additively included in the process. In short, the first year or so is treated as an extended pilot experience, building on strengths and adjusting to any obvious weaknesses which emerge.

For example, one company determined that they had put too much emphasis on SPC per se and had allowed people trained in SPC to become isolated with the responsibility for making things happen. Consequently, line managers were denying responsibility for the effort, which was viewed as an extra-organizational move rather than as a part of the operational strategy of the company. Subsequently, the effort was redefined, with the general manager of the division leading the way. Training in SPC was extended as part of a more inclusive effort involving additional elements of the Total Systems Quality concept.

An organization may have to go through three, or even four, of these consolidations. With each consolidation the basic elements of the process become more ingrained into the organization as additional elements are added. We refer to this process as *inclusive redefinition*. Effective periodic consolidation reaffirms the essential thrust of the process rather than displaces it. Each consolidation represents a gradual redefinition of the company's efforts, and former techniques are incorporated into new thrusts. If we view each phase as a new generation of the Total Systems Quality effort, we can assert that transforming the organization is a multigenerational phenomenon.

4. The transformation process requires building a critical mass of committed people at all levels of the organization for whom the concepts involved are not unique.

Transformational change requires the development of a critical mass of people who are genuinely *committed* to the new approach to managing, not merely hoping it will work, but reflexively managing with that approach. In essence, management needs to develop people who are *unconsciously competent* in that they reflexively respond to situations in a manner consistent with the Total Systems Quality approach without even having to think about the theoretical issues involved.

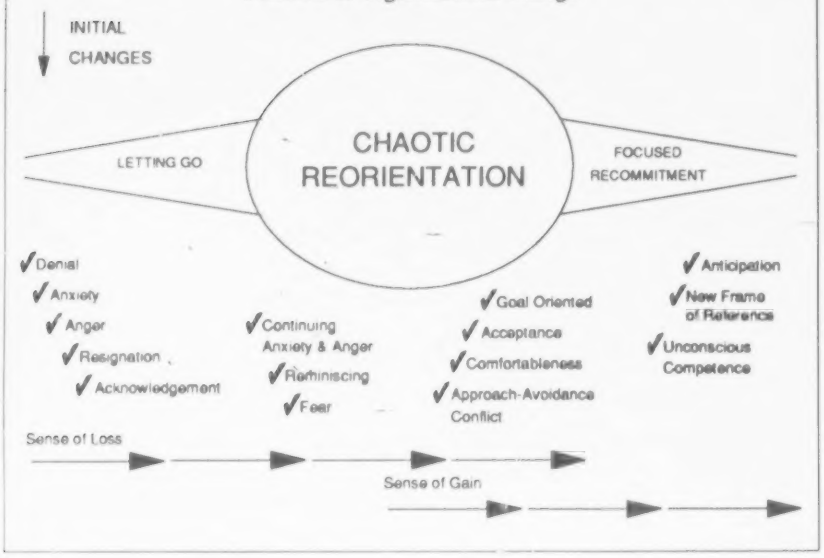
To get people to agree to initiate change is one thing. Getting them to be truly committed and unconsciously competent is quite another. The change requires that they complete a process of psychological transition--a gradual process through which individuals and groups reorient themselves to a significantly changed situation.[4]

Bridges describes the process of psychological transition as being characterized by three stages. While we find his three-stage model relevant to the question at hand, our labeling and descriptions will be a little different to better capture the psychological reactions observed in our studies. (See Figure 1.)

Stage one: Letting Go. Adopting the practices of Total Systems Quality requires managers, supervisors, and workers to leave behind many skills, prerogatives, sources of status and power and implicit assumptions about the workplace which they have formulated during their past experiences. This process of "letting go" is not easy and doesn't happen quickly. Before one can even begin letting go of those behaviors and attitudes which are no longer

4. William Bridges, *Surviving Corporate Transitions* (Doubleday, 1987).

FIGURE 1
Stages of Transformational Psychological Transition as a Function of Organizational Change



appropriate, there has to be recognition of the benefits of change and the realization that it is enviable. Otherwise, denial inhibits individuals from acknowledging that they will indeed have to adjust.

While consulting with an organization engaged in the transformation process toward Total Quality, the author attended a meeting involving the entire managerial and supervisory component of the division. The division manager made an extended presentation regarding the next stage of the process and then participated in the remainder of meeting. It was clear that important commitments had been made to the process and the division was moving ahead, building on the lessons of the past. However, one of the early statements from a manager-level participant was, "What we need is a sign that management is serious." His statement was an indicator of denial, as he was clearly hoping that all changes would pass.

Even when one accepts the need for change, it is difficult to let go of old assumptions and habits. There may be a feeling of "not having done anything for the day" when a manager spends time on training issues, gives direction in the form of information, and works on system-level problems, rather than issuing specific orders on the task itself.

Letting go is difficult because it involves loss--loss of meaning, loss of identity, loss of structure, loss of turf, and loss of what Warner Burke of Columbia University refers to as "the known and tried."[5] In working with one organization, the author asked teams of supervisors to list what they were losing and what they were gaining from Total Quality. They were able to list a long and very specific list of what they were giving up, but were very general and vague about what they were gaining. Most of the latter were restatements of the effort's objectives. As a group they classified themselves as struggling to let go and only entering the next stage: chaotic reorientation.

Stage two: Chaotic Reorientation. As managers and supervisors come to recognize counterproductive behaviors, they become hesitant to act at all. Confronted by various situations, they know that some response is necessary, but they are not sure what. Understanding that their traditional response would be inappropriate, but indecisive about what to replace it with, they become paralyzed. This reaction is typical of what we call "chaotic reorientation." Another characteristic of this stage is that individuals often experience "approach-avoidance" conflicts regarding elements of the total systems quality approach. At times they are enthusiastic, other times they are skeptical and long for the "old days."

Experts on psychological transition have long observed that such adjustments are facilitated by prolonged periods of quiet reflection as people become adjusted to a new situation. Unfortunately, the pace of organizational activity does not provide much opportunity for reflection. If anything, periods of organizational transformation are marked by even more demands on people's time. The result is a sense of psychological chaos as people grope for appropriate responses.

Stage three: Focused Recommitment. It is only after a person comes to interpret events in a way consistent with the new systems and is looking toward the future with a pattern of assumptions consistent with the Total Systems Quality approach that commitment emerges. Individuals are no longer asking themselves "what-if" type questions: they have internalized a new logic in approaching their jobs.

For organizational transformation to take place, a critical mass of individuals has to be established, first in specific work units and then seeded throughout the organization, who are well into the stage of focused recommitment. They are supplemented by new employees who are psychologically committed to the new ways of doing things simply because they don't know any other way. This is another sense in which Total Systems Quality is multigenerational.

Because each person moves through the stages of psychological transition at his own pace, building a critical mass requires nurturing the transition process per se. Actions such as recognizing past accomplishments while reinforcing the

5. Warner Burke, *Organizational Development* (Little Brown), 52.

new approach, demonstrating empathy for losses, providing people with specific tasks which will give them hands-on experience with the new methods, providing them with control over implementation issues, establishing symbols of group identity and providing training and team development activities all help facilitate the transition process. Building an organization which operates on a total quality basis is an exercise requiring both technical and social skills.

5. Transformational organizational change requires that the changes being advocated are tied to operative goals relevant to all levels in the organization.

The adoption of Total Systems Quality is often accompanied by a number of pronouncements from management regarding the high priority the associated programs are being given by management. However important such pronouncements may be, research has repeatedly demonstrated that employee behavior is very sensitive to the operative goals of their companies. Operative goals are those goals reflected in the actual operating practices of a company.

For example, in one organization, meetings at which supervisors were to address a number of quality-related issues were cancelled because management wanted to minimize costs during the fourth quarter. In another, emphasis was given to hitting production quotas regardless of quality, once market demand for their product started to strengthen. For quality-oriented systems to become part of the culture of the organization, they have to be viewed as vehicles for accomplishing the goals which management's behavior suggests are truly valued.

6. Transformational change requires constructive engagement from a stable coalition of senior managers.

Constructive engagement refers to management actions which are supportive of the change agenda in terms of their impact. While official pronouncements are commendable, the key to the transformation process lies in taking action, such as selecting appropriate successors for key managers in units which have successfully established key systems, seeding of managers and supervisors who are conversant with such systems throughout the organization, linking operative goals to the quality effort and nurturing the development of a critical mass of committed people. Indeed, taking a low-key approach initially, while establishing dynamics supportive of points 1 through 5 above, is often more helpful than an initial verbal show of support that leaves a group of middle-level managers to implement the philosophy which has been pronounced from above.

Just as a critical mass of committed people must be developed at the operational level of the organization, a stable coalition of senior line managers must be forged who are consistently demonstrating their support for Total Systems Quality. In the absence of such a coalition, the company should maintain a relatively low profile for the effort while developing both the coalition at the top and a substantial group of committed work units throughout the organization. This approach allows for solid progress without raising excessive expectations. Unmet expectations lead to cynicism and undermines the effort, making subsequent progress more difficult.

FIGURE 2
Three Component Systems of Organization Action

Technological/Job Motivation System--The pattern of organization and utilization of resources to convert inputs into outputs

- ✓Machines
- ✓People
- ✓Information

Control/Support System--Process through which performance of the technological/job motivation system is influenced

- ✓Direct supervisory intervention
- ✓Selection of resources, including people
- ✓Training
- ✓Rewards & punishments

Equity/Commitment Systems--Mechanisms and procedures which define employee rights and privileges, including symbolic representation of those rights

- ✓ Appeal processes
- ✓Participation in policy setting
- ✓Compensation basis
- ✓ Access to facilities
- ✓Perquisites

Leveraging Change

There are three basic sets of organizational needs for which any organization must provide. The first is the structuring of processes through which the core operational tasks of the organization are accomplished; the second is providing for control of these processes; the third is addressing issues of organizational citizenship in terms of their rights and privileges and the symbolic representation of those rights. These three sets of needs, as illustrated in Figure 2, are conceptualized here as being met by (1) the technological/job motivation

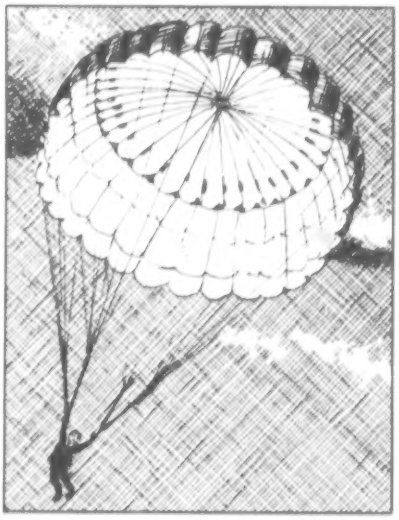
system, (2) the control/support system and (3) the equity/commitment system.

The technological/job motivation system is defined as the organization and pattern of utilization of resources (including capital; technical, material, informational, and human resources) for the conversion of inputs into outputs. How jobs are designed, the type of information which becomes part of each worker's job, and the type of input workers have into their jobs are all factors which shape the character of the technological system. In addition to the efficiencies and cost structure which are created through the resulting workflow, there is an impact on the intrinsic job motivation of employees. Specifying the distinction between common and special causes, synchronous flow, SPC, and organizing workers into teams are all factors that impact the technological/job motivation system of organizational units.

The control/support system is the set of arrangements through which management seeks to influence employee performance. These include the selection of employees, training practices, supervisory role specifications, and performance incentives. With the introduction of Total Systems Quality, a subtle but significant change in the control orientation of the organization must occur. Direct control such as supervisory intervention in the work itself can no longer be a principle method for responding to problems. Increased reliance has to be placed on the careful selection, training and recognition of employees who in turn react to performance problems in the work process. Cost and financial accounting measures, which are also part of the control/support system, must be made congruent with any changes in the technological/job motivational system. While these activities can help influence performance, if they are properly implemented they are viewed by employees as supportive of their efforts.

The equity/commitment system includes organizational mechanisms for employees to appeal perceived unjust treatment, as vehicles for employee participation in decisions affecting the business (as opposed to one's job), as access to certain facilities (dining, parking etc.), and as the basis upon which people are paid (i.e., piecework, hourly, salary, and corporate bonus employees). They define employee rights and privileges within the organization. Each has a symbolic as well as a substantive dimension. They communicate relative status as well as determine the broader range of an employee's quality of work life. To the extent employees perceive these practices to be exclusionary, their commitment to the organization as a social entity is likely to be lessened.

The three systems are loosely coupled, and unfortunately some companies end up organizing them in ways that work at



cross-purposes. An example is a manufacturer which attempts to organize its workers into teams or flexible work groups that monitor statistical data among other things (representing a change in the technological/job motivation system), while failing to provide comprehensive training (control/support) and threatening to lay off employees as a purely managerial prerogative (an equity/commitment issue). The managerial challenge is to establish elements of all three systems which are complementary to one another and to form a coherent strategy of administration.

The case of employee involvement. As the article by Larry Pace elsewhere in this issue makes clear, employee involvement can take various forms. Unfortunately, many organizations have rushed to establish employee involvement groups with little consideration of how these groups are to become part of the component systems of the organization. In our opinion, the most fundamental form of employee involvement centers around the job itself, with employee teams problem-solving as part of their job responsibilities. Task forces which work on specific product/process-related issues are supplementary but valuable activities which represent an extension of these job responsibilities. Adequate training is a necessary control/support function for both of these involvement vehicles. Here again, experienced employees can assume responsibility for the content of these programs.

Employee involvement should be directed toward specific tasks the company needs accomplished with the expectation that initial efforts will evolve toward more inclusive activity. This approach is substantially different from creating extraorganizational structures to administer a proliferating number of groups. That in itself becomes an extension of the bureaucracy in which form, rather than substance, becomes the measure of progress.

Summary

The task of transforming organizations requires recognition of the nature of the extended nature of the process. Our recommendation is for developing strategies which assume the characteristics of transformational change discussed above and seek to additively implement techniques that build congruence between the three component systems of the organization. Senior management must gear its activities to these characteristics if it is to provide effective leadership that leaves its successors not only with a competitively positioned enterprise, but an organization with a positive attitude toward change. Progress can be made immediately. Indeed, organizational transformations require continuous efforts which build on initial successes. Ultimately, however, building new values into the cultural fabric of organizations is a multigenerational process. ■

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MOVING TOWARD SYSTEMS INTEGRATION

by Larry A. Pace

Employee Involvement (EI), a process for empowering members of organizations to make decisions and solve problems appropriate to their levels in the organization, is seen by most Total Quality Management (TQM) authorities as a necessary ingredient for overall organizational effectiveness. Typically, the goals of EI are increased productivity and improved employee satisfaction.

Whereas EI is an individual process, TQM is usually conceived as a companywide approach intended to bring under control all the processes and systems of the organization. TQM is traditionally defined as the attainment of zero defects or the attainment of complete customer satisfaction. For the purposes of this article, however, TQM, as defined by Harlan Carothers, has as its goal continuously increasing user value simultaneous with continuously decreasing user sacrifice. The potential conflict between TQM and EI and the need for integration can now be seen clearly. EI is philosophically oriented toward the increase in commitment via a reduction in management control, while TQM is usually implicitly or explicitly oriented toward an increase in management control.

Approach Definitions

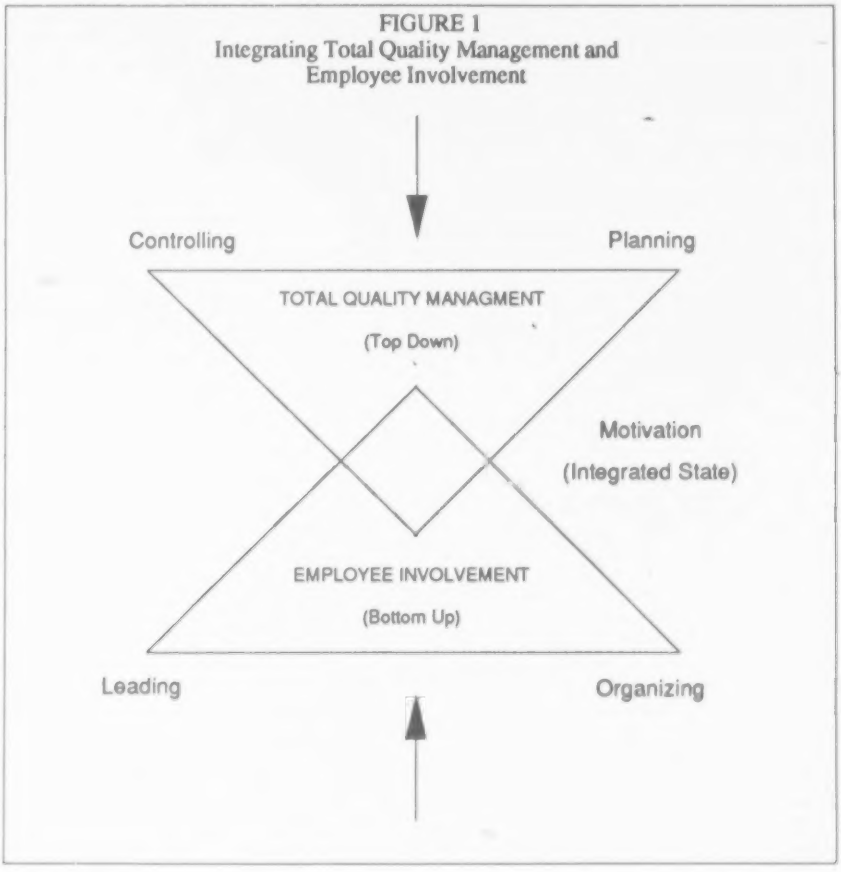
EI means living with creative solutions and the resultant variety of approaches, while TQM strives for standardization of work processes and work outputs. Organizations sometimes implement both processes simultaneously without integrating them. In such cases, the two processes can work at cross purposes. These conflicting approaches can produce unintended results in the organization. Sending mixed signals to the work force as to management's true intentions would be the most undesirable result.

Conceptually, the integration of TQM and EI is quite straightforward, as indicated in Figure 1, which I developed with Waino Suojanen. In this model, TQM is a

vehicle for deciding what is important to work on and EI is a vehicle for deciding how to go about working on these objectives.

By exercising direction in choosing the right thing to do (Planning), and doing things right (Control), management can then allow employees discretion in how to get things done (Leading or Self-Management) and how to do things together (Organizing). This cooperation results in a tops-down focus on planning for continuous improvement of user value and reduction in user sacrifice, combined with a bottoms-up focus on getting things done by working together. This integrated process becomes the way things get done.

FIGURE 1
Integrating Total Quality Management and Employee Involvement



Commitment/ Control

The commitment/control issue is quite easily resolved (at least conceptually) by the assumption that highly committed individuals will practice self-control and that rigid external control is therefore unwarranted, except perhaps in extreme situations. Practically, however, this integration is hard to achieve and sustain, as the following illustration shows.

Because of strict headcount targets driven by intense competitive pressures, a group level vice president in a large R&D organization insisted that no hiring take place without his personal approval. The decision was made in spite of several years of experience with EI and TQM, and its effect was that a powerful message had been sent to subordinate managers, namely: *I have more power than you, and I will decide when EI is appropriate and when it is not. Further, I cannot trust you to make the correct decisions for hiring.*

This autocratic decision did much to undermine the commitment of lower level managers and human resource personnel. When the VP took over the hiring process, subordinate managers and personnel professionals no longer felt personal accountability for the quality of hiring decisions. Finally, the VP spent his time doing what he already had the staff to do at the possible cost of more important things. This was not only demoralizing for the rest of the staff, but expensive to the organization. Such executive behavior is easy to explain (especially after the fact) and fairly easy to predict (based on past observations), but extremely difficult to control and change.

EI Failure Rates

Roughly 75 percent of EI efforts in U.S. corporations fail within two years. The most commonly cited causes of failure are the lack of management involvement and support or the argument that the process does not "fit" the culture or climate of the organization. A third frequently cited cause is the inherent design limitations of such involvement vehicles as quality circles (QCs). All these reasons are potentially valid, but the causes of EI failure are highly interrelated.

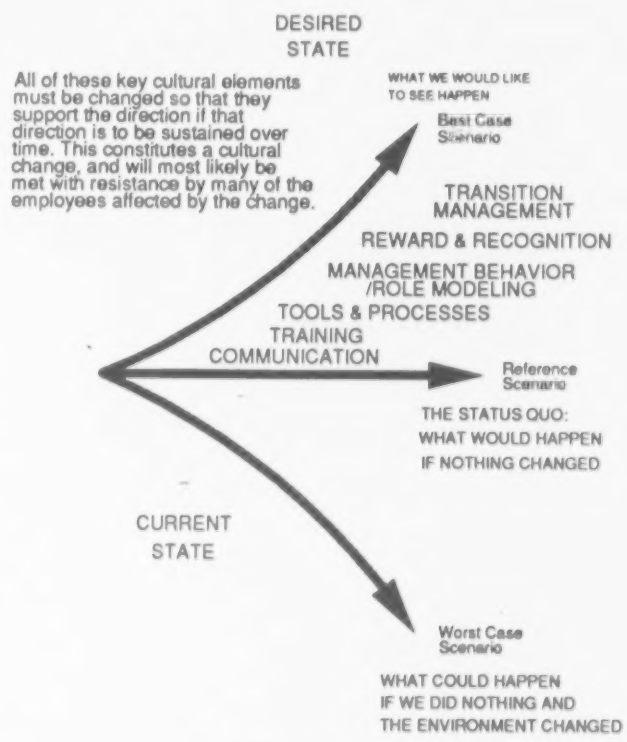
Lack of management support. Many managers neither understand nor know how to implement their changing roles vis-a-vis EI. Second, traditional managerial reward systems focus on control and outcomes, not on commitment and process. Thus, managers in control-oriented systems may actually be punished for their efforts to increase EI. Third, the majority of managers

in the U.S. have adopted a short-term perspective. Coupled with the inherent slowness of such a process as quality circles, this short-term focus frequently leads to frustration with and ultimate abandonment of EI. Fourth, many managers find letting go of power and control difficult, if not impossible.

For these reasons, managerial support for EI is difficult to achieve and maintain, and will not last, apart from major shifts in managerial reward structures.

Lack of fit with the organization. The lack of fit is seen most frequently in two cases. In the first case, a high-involvement vehicle such as self-managing work groups is chosen and implemented as a pilot within a highly control-oriented system. In this case, the involvement vehicle is treated by the larger organization as an unwanted, foreign event. In the second, more subtle case, an appropriate involvement vehicle is chosen, but it is not integrated with the ongoing operations of the organization.

FIGURE 2
The Necessary Steps in Culture Change


DESIRED STATE
All of these key cultural elements must be changed so that they support the direction if that direction is to be sustained over time. This constitutes a cultural change, and will most likely be met with resistance by many of the employees affected by the change.
WHAT WE WOULD LIKE TO SEE HAPPEN
Best Case Scenario
TRANSITION MANAGEMENT
REWARD & RECOGNITION
MANAGEMENT BEHAVIOR /ROLE MODELING
TOOLS & PROCESSES
TRAINING
COMMUNICATION
Reference Scenario
THE STATUS QUO: WHAT WOULD HAPPEN IF NOTHING CHANGED
CURRENT STATE
Worst Case Scenario
WHAT COULD HAPPEN IF WE DID NOTHING AND THE ENVIRONMENT CHANGED

Design Limitations. Quality circles have been criticized for being an adjunct of the work environment rather than an element of the actual organizational design, such as self-managing work groups. For this reason, QCs are seen as something that goes on outside the regular business of the organization.

A QC working for one or two hours per week on a significant problem may take three months or longer to reach a solution. By that time managerial interest has often waned, or worse yet, conditions have changed so much that the solution, while effective for the original problem, has become irrelevant. Although the contribution potential of QCs as practiced by U.S. organizations is quite low, control-oriented managers and control-oriented work systems lean toward the QC model of EI and often will not support more intensive forms of involvement.

Forms Of EI And The Congruence Hypothesis

According to Edward E. Lawler III, there are three general categories of employee involvement: parallel suggestion involvement, job involvement, and high-involvement work systems. To be successful, the form of involvement chosen must be congruent with the current organizational operating systems, culture and climate, and the organization's strategy.

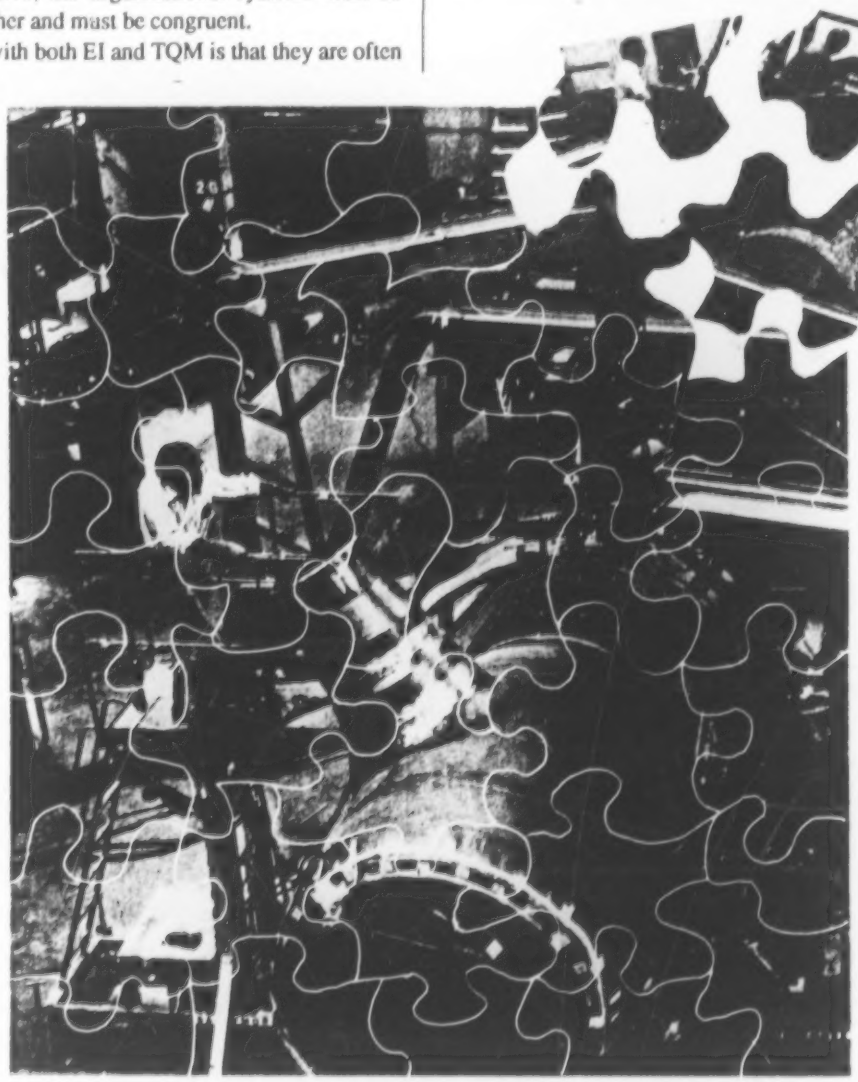
QCs are a form of parallel suggestion involvement along with suggestion systems, comment programs, and open-door policies. Although these forms of involvement do not maximize the contribution of employees, control-oriented managers tend to prefer these approaches because, under them, the managers retain power and control.

Job involvement approaches may be individual (such as job enrichment), or group-based (such as self-managing work groups). These approaches include problem solving and decision making within the job, rather than outside the job. High-involvement work systems feature job involvement and a team-oriented work design with supportive managerial roles and organizational design.

Organizational Subsystems And Congruence

Organizational change efforts, whether bottoms-up like EI, or top-down like TQM, must work within the "arc of the possible." This way of looking at change implies that if the change is too radical or too sudden, it will be dismissed out of hand by the larger organizational system. Furthermore, for organizations to be maximally effective, the organizational systems must be aligned with each other and must be congruent.

A major problem with both EI and TQM is that they are often implemented in direct contradiction to the current operating systems of the organization. The hope is that EI or TQM (or both together) will change the organizational systems. The reality is often quite the opposite. The trick, of course, is first to integrate the subsystems of the organization and make them as congruent as possible. Second, the organization's leaders must decide on a directional course and specify the role that EI and TQM will play in that new way of doing things. Third, the organization must integrate TQM and EI with the current operating practices of the organization in such a way that they fit within the arc of the possible. Fourth, the organization must iterate this process. Gains must be consolidated and institutionalized and a new arc of the possible defined.



In making progress toward the ideal state, the organization must be prepared to deal with resistance to change and must understand that change doesn't just happen by itself. Figure 2 represents a model that shows the necessary steps for making such change happen. These steps include communication, training, tools and processes, managerial role modeling, reward and recognition, and transition management.

The Case Of Xerox Corporation

The case of the Xerox Corporation in many ways illustrates the larger context of organizational change in the U.S. In the early-to-mid 1970s, the company was faced with declining profit margins, changing worker values, intense competitive pressures both foreign and domestic, and an increasingly complex functional organization.

I was employed by Xerox in 1979 to help start the EI process in manufacturing. These efforts were co-sponsored by the Amalgamated Clothing and Textile Workers Union. EI was a bottoms-up grass roots effort to get functional employees (hourly workers, technicians, engineers, office workers, and first-line supervisors) involved in problem solving and decision making. This process was quite successful in its initial stages, but over time it became obvious that to earn middle management's support, EI would have to be more fully integrated with the objectives of the organization.

In late 1982 Xerox corporate ladders developed a vision for the company that is still very much alive and well today. This vision

was called Leadership Through Quality. Founded on the early success of EI and competitive benchmarking, it added a third strategic focus: customer satisfaction through continuous quality improvement. This effort was conceived as a tops-down corporate culture change.

The Leadership Through Quality strategy was not inexpensive. Xerox spent the equivalent of six full working days of training in problem solving, quality improvement, and interpersonal skills for every employee (over 100,000 worldwide) as the initial investment. This initial effort has been followed by concerted efforts to improve the planning, controlling, and managerial systems of Xerox so that they reflect a consistent focus on internal and external customer satisfaction.

Ingredients of success. For Xerox, the tops-down focus on continuous quality improvement and the bottoms-up focus on getting things done by working together have been integrated successfully. My job in manufacturing from 1983 to 1985 was to do just that along with the union. The integration involved all of the following:

1. Tops-down training and application by family group (a manager and his/her direct reports)

2. Significant changes in managerial reward, recognition, and promotion systems

3. Reverse performance appraisal, in which subordinates evaluate the degree to which their managers are providing good role models of the desired behaviors

4. Evolution of the EI efforts beyond quality circles. The EI efforts have evolved to more job involvement with the individual employee and the work group responsible for identifying their customers and satisfying those customers' requirements.

5. Periodic "process checks." Since 1983 family groups in the Development and Manufacturing organization of Xerox have participated in annual self-inspection in which they rate themselves against the desired state published in the original Leadership Through Quality strategy.

All of these efforts have paid off handsomely for Xerox. The company has been a leader in EI and now is a leader in TQM. The success of EI led to negotiated job security for union members, easing their fears and rewarding their trust. And the emphasis on customer satisfaction and cost reduction has allowed Xerox to regain market share in an intensively competitive business. ■

PROCESS CONTROL AND QUALITY IN THE CONTINUOUS PROCESS INDUSTRIES

by Kenneth E. Kirby and Charles F. Moore

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There is an interest in quality management in this country which is growing exponentially. The interest is in more than just product quality. It also concerns the effectiveness and consistency of all the various systems which are involved in either producing, pricing, or delivering the product to the customer. Further, it involves a commitment to continually studying and making changes in all those systems which affect quality and productivity. The basic concept is to build quality into all the organizational systems (both engineering and management) and to make quality everyone's responsibility.

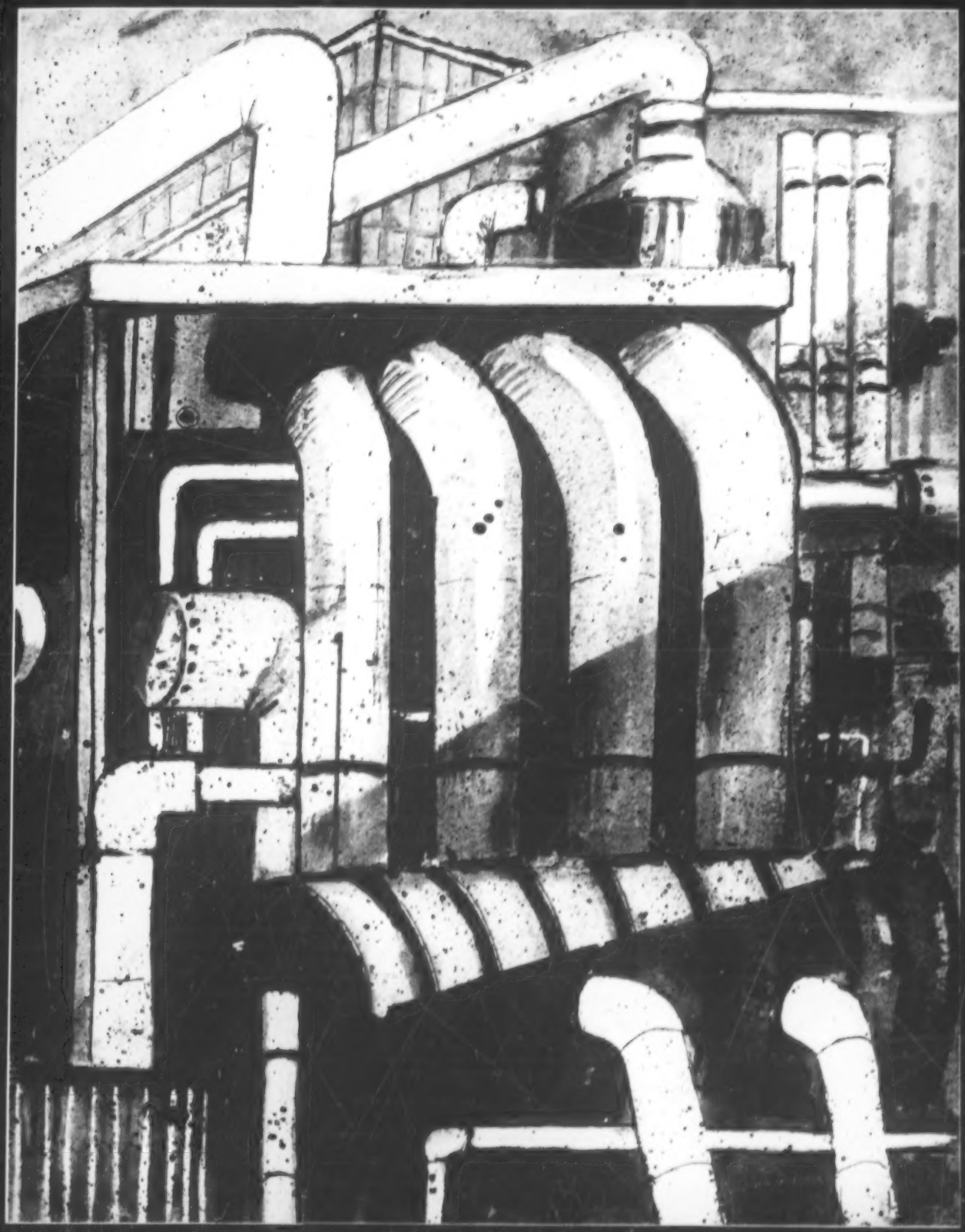
The new focus on quality management represents a revolution which started in the automobile industries but has spread to include a wide spectrum of industries. Although the basic concepts are the same, many of the specific quality issues vary from industry to industry and from process to process. This paper will focus on some of the important issues concerning improving quality and productivity in the operation of continuous processes.

Continuous Manufacturing

The focus of this article is on continuous processes, that is, those processes which mix, react, and/or separate materials continuously. A petroleum refinery consists almost entirely of such continuous processes (i.e,. pipes, pumps, stills, distillation columns, reactors, furnaces, etc.). Chemical, pulp and paper, and electrical power are all examples of industries which use primarily continuous processes. Such processes are a very significant part of American industry and present some unique challenges with respect to controlling and improving quality.

It is perhaps important to point out that most manufacturing is a mixture of both discrete and continuous operations. For example, consider a chemical plant which produces nylon. The processes which prepare the reactants are continuous while the autoclaves which actually produce the nylon operate in discrete batch stages. The materials processed are also both discrete and continuous. The chemical reactants are liquids (continuous material) and they produce solid nylon pellets (a discrete material).

Consider also an example of a computer assembly plant. Such a facility will have many discrete



assembly lines but may also have a power plant which produces steam and chilled water for the facility. The boilers, chillers and cooling towers used by that power plant are all continuous processes in which there should be some focused concern for quality.

Control of Continuous Processes

There are many systems associated with continuous processes. With respect to quality, perhaps one of the most important systems is the one used to control the operation of the process. Continuous processes typically consist of a number of units which are interconnected by pipes through which material and energy flow. The operation of such complex, convoluted, and highly nonlinear plumbing systems are easily upset by both internal and external disturbances. The effectiveness of the control system in reacting to such disturbances is an important issue with respect to quality. Poorly controlled processes generally have lower capacities, poorer yields, higher energy costs, and broader variations in product purities than a similar process which is well controlled.

There are two control technologies which are important in the control of continuous processes: Engineering Process Control (EPC) and Statistical Process Control (SPC). Understanding the role and focus of each of these technologies is important in building quality into the system which controls the process. The role of engineering process control is to automatically adjust the process operation to correct for disturbances as they occur. Statistical process control, on the other hand, is focused on better understanding the process operation so that the most important sources of variations which effect quality can be identified and eliminated (or at least reduced.)

Both SPC and EPC play an important role in controlling and improving the operation of a continuous manufacturing operation. When and where to apply the two control technologies is a complex but important question for the continuous process industries. It is seldom simply a matter of choosing one control technology over another. Choosing how to mix and match and how to integrate these systems is the challenge.

Allocation of Resources

One important difference between SPC and EPC concerns human resources. In engineering process control the control functions are fully automated and implemented in special purpose computers which are directly connected to the sensors and valves on the process. In statistical process control the operators, engineers, and managers associated with the process are an integral part of the feedback loop. Perhaps one of the most important aspects of the balance between SPC and EPC has to do with the allocation of man vs. machine resources. In the continuous process industries, human resources are the most scarce. Typically the ratio of the number of significant process variables to the number of control room operators is very high, compared to discrete manufacturing. It is important not to load the limited human resources down with too many and too frequent SPC chart functions. It is equally important not to attempt to automate (in an engineering sense) so completely that those people who are responsible for the operation of the facility no longer have control of the operation. Both computer and human resources are needed to monitor and control a complex process.

The effective allocation of those resources in reducing variation in a continuous manufacturing environment depends on many factors. Some of the more important considerations are (a) the nature and source of variation; (b) dynamic characteristics of the process; and, (c) the nature of the sensor and actuator. These considerations will be discussed in the following sections.

Nature and Source of Variation

One of the main purposes of any process control system is to reduce variation. The decision as to which control technology is appropriate to use depends heavily on the nature and the source of that variation. Consider the following common sources of variation typically found in the continuous process industry.

Material Balance Disturbances. In deciding between SPC or EPC, it is important to distinguish between variations which can be eliminated at the source and those which cannot. One important source which often cannot be eliminated is a change in the material balance around the plant. For example, consider the effect that a change in crude oil supply might have on the operation of a refinery. The composition of the crude oil feed to the refinery varies with each oil field. As these variations enter the refinery it is necessary that many subtle adjustments be made in the operation in order to insure that smooth and economical operation is maintained. Adjusting for those unavoidable material balance changes is one of the historical roles of engineering process control. Variations in the composition of raw feed stocks is a different problem from the variations in the physical attributes of a part supplied to an assembly line operation. It is possible to negotiate a contract with the part vendor which specifies tolerance on variation. It is much more difficult to negotiate with Mother Nature. There is little choice but to take it as it comes, variation and all.

Energy Balance Changes. Energy balance disturbances are much the same problem. Most (if not all) assembly line operations are housed in protected and well-conditioned environments. Continuous process operations, on the other hand, are often totally exposed to the elements (wind, rain, sun, ambient temperature, barometric pressure, relative humidity, etc.), and those elements are always changing. In most cases it simply is not practical to either insulate the process totally from the environment nor negotiate with the weather man to insure that the variations are small. Processes which are sensitive to these variations usually depend on engineering systems to make continuous or at least frequent adjustments in the energy balance in order to keep the unit operating properly.

Process Instabilities. Another source of variation which requires (i.e., demands) a properly designed engineering control system is that of process instabilities. Most processes are relatively stable in operation, but there are many which are not. Reactor systems are perhaps the most notorious examples of processes which can have dynamically unstable modes of operation. In such cases, if left unattended (in a control sense), they can move rapidly to a mode of operation which is beyond control. The consequences may mean that the unit must be shut down and restarted, or it could be much more catastrophic. An unstable process which is not properly stabilized by a process control system can literally be an explosive situation.

Process and Measurement Noise. Measurement noise can also be an important source of variation. High-frequency fluctuations in the process measurement can become a serious problem when converted by a control system into lower frequency process variations. If possible, the cause and source of such random variations should be eliminated; however, in many cases this is not practical or even possible. The high-frequency noise

detected at the sensor can be simply an artifact associated with the poor measurement practices or it can be part of the physics of the process itself. It is important to realize that the presence of such noise can be a problem in a tightly tuned engineering control loop. If the control system responds to the noise, not only will local variation likely increase in magnitude, but the otherwise local problem can well be propagated to other parts of the plants. SPC, on the other hand, is much less sensitive to noise and other high-frequency disturbances. The SPC loop is sensitive, however, to the more important low-frequency changes which happen much more slowly. There are many situations, especially in a noisy environment, when the conservative SPC focus is the most appropriate control technology to use in responding to disturbances. Often, in these situations, the nervousness of an EPC loop can inadvertently create more problems than it solves.

Equipment Failure and Wear. Some sources of variation are unavoidable; however, many can and should be detected, identified, and eliminated as quickly as possible. Statistical process control is a much more appropriate framework for this concern than is engineering process control. Consider a heat exchanger which has a steam trap stuck open or one in which the heat transfer surfaces have gradually become coated with mineral deposits. Both problems (one happens suddenly and one happens slowly) result in a decreased efficiency of the heat exchanger in transferring energy from the steam to the liquid. The engineering process control system makes no distinction between avoidable and unavoidable disturbances. It will adjust the steam flow rate to whatever is necessary to maintain the target temperature. A well-designed SPC loop will, however, call attention to the fact that the exchanger is not operating normally and that the special cause of the increased steam consumption needs to be identified and corrected.

Poor Control Loop Performance. SPC can also be used to detect and call attention to engineering process control loops which are not working properly. It is not uncommon for the performance of a control loop to degrade due to subtle changes in the process. In most cases the problem can be easily eliminated by retuning the controller. In other cases the problem may be more serious and require a closer look at the process. In either case, the problem cannot be corrected until its presence is detected. SPC is the feedback framework for detecting such abnormal process operation.

Dynamic Characteristics

Another important question concerns the nature in which the process responds to the world around it. The dynamic behavior of the various process units in a refinery can be quite different with respect to how they respond to the various changes in the material and energy balances that affect them. In general, these dynamic characteristics effect both the difficulty and the urgency of the control problem. Both are important concerns in choosing between SPC and EPC.

Speed of Response. Due to process inertia, changes seldom occur instantly. If the flow of steam into a heat exchanger is increased, the temperature of the liquid will also increase, but it will take time for the full effect of the change to be realized. The speed of this response is an important factor in designing the control loop. For example, the effectiveness of a SPC loop may be very much affected by a process which responds slowly. If the process response is slow relative to the frequency of the control focus, the sequential process measurements will not be independent events (as assumed in the design of most SPC charts) but will exhibit some level of autocorrelation. The presence of such autocorrelation creates a problem when one is using the traditional control chart. It makes it difficult to establish control limits and utilize runs rules (modified Shewhart chart) which are sensitive to special causes but which do not give frequent false alarms.

Processes which respond very quickly can also present a problem for SPC. The frequency of a control chart which is to be maintained by a human operator is sometimes limited. Operator responsibilities could result in situations where the charts have no more than an hourly focus. An hourly focus on a process which responds in minutes may be totally inadequate in terms of the control requirements for that process. It is possible, of course, to automate a control chart so that it can run at frequencies much higher than practical for a human to maintain. Such an implementation may be quite effective (and entirely appropriate) but it is no longer traditional SPC. Traditional SPC assumes that some person with a knowledge of statistics plays an active role in the control of the process. In terms of this paper all control strategies that are totally automated in a computer are considered to be EPC systems.

Order of the Response. The dynam-ics of a process are characterized not only by speed but also by order. The order concerns the more subtle characteristics of the response of the process to changes. Generally speaking, the simpler the order the easier it is to control the process using a simple EPC loop. On the other hand, processes which demonstrate complex dynamic order, are often difficult to control using conventional engineering feedback systems. In such cases, more complex model-based EPC algorithms may be required. In other such cases, it may be much more appropriate in terms of reducing variation to forget about tight dynamic control and simply be content with the conservative steady state focus provided by a conventional SPC chart.

The Nature of the Sensor and Actuator

The measurement and the manner in which control actions are implemented are important considerations in choosing a control technology. SPC is certainly favored in the discrete manufacturing environment in which the measurements are typically attributes taken from physical samples and the control action tends to involve some mechanical adjustment or modification to the discrete operation. There are analogous situations in the continuous process industries; however, the sensor and actuator environments are typically quite different from those found in discrete manufacturing.

On-Line vs. Sampled Measurement. One important measurement concern is whether the process requires a sample be taken and an off-line determination made or whether measurements can be made continuously on-line without sampling. Temperature, flow, pressure, and level are all examples of measurements which can be easily taken from the process on a continuous basis. On the other hand, subtle analytical measurements, such as viscosity and composition, often require that a sample be taken and analyzed in a laboratory. The laboratory which makes the determination can be a totally automated package (seldom an inexpensive option even when it is available) or it can be one which requires human operators. The longer the time required to make the determination, the more heavily SPC is favored over EPC.

Cost of a Control Move. The cost of a control move is another important (and

sometimes confusing) concern. If the control move requires that the production line be stopped to make an adjustment, the cost of that move could be quite high. The control policy should be quite conservative with respect to making any unwarranted moves which result in unnecessary lost production. For continuous processes, however, the costs are often not quite so obvious and clear cut. Most actuation in the continuous process industries is accomplished by control valves which are designed to smoothly and continuously adjust the flow of material or energy as directed by the control system. The direct cost of such a control move is usually very low; however, the indirect cost can be quite high. It is important to understand that in an engineering process control loop, variation is shifted from the process characteristics being measured to the process parameters being manipulated. In all such loops, variation in the process measurement is reduced at the expense of an increase in variation in the variable being manipulated. The cost of such a shift in variation has to be understood in terms of the larger plant picture. The variable being manipulated can be harmless, or it can well cause an even more costly disturbance to occur elsewhere in the plant. If such is the case, the control system should be much more conservative than it would be if no cost were associated with the control move.

Process Control and the Plant Culture

The movement behind quality management has a larger focus than just the engineering systems involved in the manufacturing operation. The focus is on all systems (engineering or management) which effect quality. The push behind total quality management is on moving the overall company culture to one which better promotes quality and productivity. The nonprocess sytems, such as maintenance, plant safety, cost accounting, performance evaluation, marketing, etc. are all important to how employees relate to the process and perceive their role in improving quality. The idea is that all systems may have "value detracted" components which degrade overall quality and productivity.

It is not within the scope of this paper to discuss all of the many cultural issues which can ultimately effect the quality of control of continuous processes. There are, however, a few issues of concern which are extremely important but which have often been neglected. These issues concern primarily the process control organization and its relationship with other key groups in the plant.

Process Operation and Process Control. There needs to be a strong, active connection between the group that is responsible for the operation of the process equipment and the group which is responsible for designing the systems that control that equipment. The plant culture can foster that essential connection, or it can make it difficult. For example, a plant culture which treats process control as a branch of data processing is not likely to be successful in designing effective process control systems. An organizational culture which keeps its process control people locked in an ivory tower away from the process is also likely to produce control systems which are poorly focused, if not totally inadequate. A control culture which places more importance on advanced engineering process control than on good common process sense is likely to design control systems which are overly complex and fragile. On the other hand, a process control organization which is committed to continual improvement must work closely with the people who are responsible for running the process. They will make sure that the control system designs are clearly understood by the process operators and they will learn from these people what works, what does not, and the reasons why. The process engineers and the control room operators are the people who best understand the process. A sound connection with those two groups is vital to any healthy process control organization.

Process Design and Process Control. Historically there is also a need for a stronger relationship between the process control organization and the plant group which is responsible for the process design. Unfortunately, the traditional relationship is rather one-dimensional. Continuous processes are designed and in many cases instrumented before the control systems group becomes involved. Such a culture often produces plants which were not designed to be controlled, and as a result they are, in fact, difficult (and sometimes impossible) either to operate or to control. Can you imagine what the results would be if the control system for aircrafts were designed in such a culture? Certainly, for continuous processes, many of the control problems could best be eliminated at the process design phase before they become fixed in concrete and steel. Process control should be an integral and inseparable part of all stages of plant design.

The process design and process control groups should also play a more active role in helping the process operations group plan changes and modifications to existing equipment. The process should be continually studied to determine those changes which would either reduce variation or make that equipment easier to operate and control.

Process Control and the Control of the Process. Engineering process control has had an organizational presence in the continuous process industries for many years. Now, with the emergence of statistical process control there is a new and typically separate organization which is also concerned with the control of the process. In many plants today there are territorial conflicts and battles royal over who and what is in control. It is certainly an unproductive plant culture which encourages such tension. These two groups clearly have to work closely together if the control systems and practices are to continually improve. The first step in working together probably means that control engineers are going to have to learn some of the basic principles of statistical control and that the statisticians are going to have to learn something of engineering process control. The second step is to learn how to properly mesh these two technologies into a single technology addressing the operation and control of continuous processes. There is perhaps a third step. It is the step which integrates these two technologies more completely with the concept of continuous improvement and total quality management.

Conclusions

It is important for everyone committed to total quality management to have a clearer understanding of the operation and control of continuous processes. Continuous processes constitute a major segment of our total manufacturing base and need proper attention. Potentials for improvements are great, and there seems to be considerable slack not only in the processes, but also in the many engineering and management systems which surround them. It is time for all who want to stay competitive to start systematically trying to take up the slack. ■

PROGRAMS OFFERED BY THE UNIVERSITY OF TENNESSEE MANAGEMENT DEVELOPMENT CENTER

The University of Tennessee's Management Development Center seeks to meet the development and training needs of business and industry through a variety of programs:

- **The University of Tennessee Executive Development Program**. A four-week (nonconsecutive) program directed toward general managers and senior functional managers. This highly participatory and comprehensive program offers an intensive, comprehensive learning experience, utilizing key University of Tennessee faculty and nationally recognized consultants. Participants study such topics as managerial effectiveness, financial decision making, international marketing, productivity through quality, and strategic planning.

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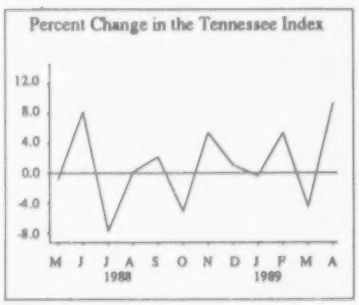
For more information about Management Development Programs, call or write John Riblett, Director, Management Development Center, College of Business Administration, Stokely Management Center, The University of Tennessee, Knoxville, TN 37996-0570, (615) 974-5001.

TENNESSEE ECONOMIC OVERVIEW

(April Index as of June 22, 1989)

The Tennessee composite index of leading economic indicators increased from 114.2 in March to 115.1 in April, a 9.3 percent increase at a seasonally adjusted annual rate (SAAR). This follows weak performance in March, when the index fell at a 4.5 percent SAAR. April's large increase is welcome news, particularly since it prevents a negative trend from developing. However, the secular growth of the index remains modest. Overall, the index has increased by only 1 percent since April 1988.

Among the seasonally adjusted components of the index, the tax related variables performed poorly in April, while the non-tax components showed strength. Real taxable sales decreased at a 33.7 percent SAAR, offsetting almost all of the gain in March. This places real taxable sales 2.4 percent below April 1988. Real taxable mortgages declined as well. However, the index was buoyed by increases in the U.S. leading index and total Tennessee construction starts, and the third consecutive monthly decrease in initial claims for regular Tennessee unemployment insurance. The U.S. leading index increased at a 9.5 percent SAAR, slightly faster than Tennessee's index. This followed two months of declines and was a relief to many forecasters since three consecutive decreases is often considered a harbinger of a recession. Tennessee construction starts jumped suddenly in April, resulting in the largest number of starts in a single month since March 1987.

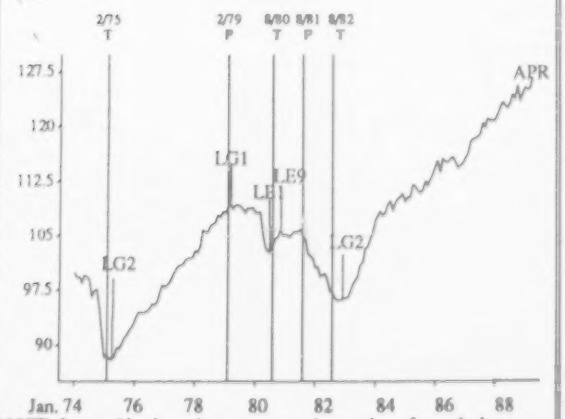


The Tennessee composite index of coincident indicators also increased in April, from 125.3 to 126.8. This represents a 15.7 percent increase at a SAAR and continues a moderate upward trend that has placed the index 2.7 percent above April 1988.

Two of three seasonally adjusted components contributed to the April increase. Tennessee commercial and industrial electricity consumption increased, resulting in 4.3 percent growth since April 1988. The Memphis help wanted index grew as well, but has been flat in the aggregate since April 1988. The U.S. coincident index was the only weak component of Tennessee's coincident index in April. However, the decrease was a small 0.9 percent at a SAAR.

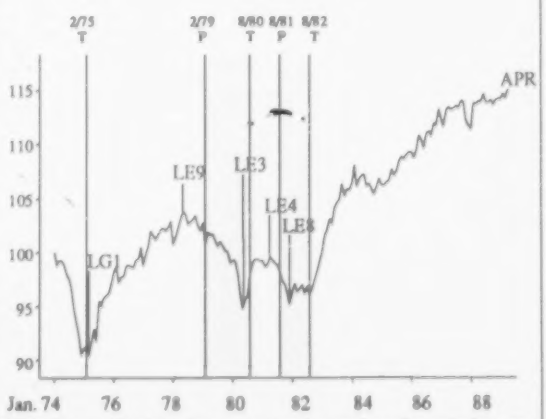
Despite favorable performance of the Tennessee composite indices in April, seasonally adjusted nonagricultural employment continued to decrease. April was the third consecutive monthly decrease in nonagricultural employment. Thus, a disturbing trend is developing in Tennessee's labor markets. However, the seasonally adjusted Tennessee unemployment rate dropped to 5.2 percent, which was slightly below the U.S. unemployment rate.

FIGURE 1
Coincident Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the coincident index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

FIGURE 2
Leading Index



NOTE: Lag and lead numbers represent the number of months between the peak or trough of the leading index and the middle of the peak or trough quarter of the reference series index.
LG = Lag; LE = Lead
P = peak; T = trough

TENNESSEE ECONOMIC INDICATORS

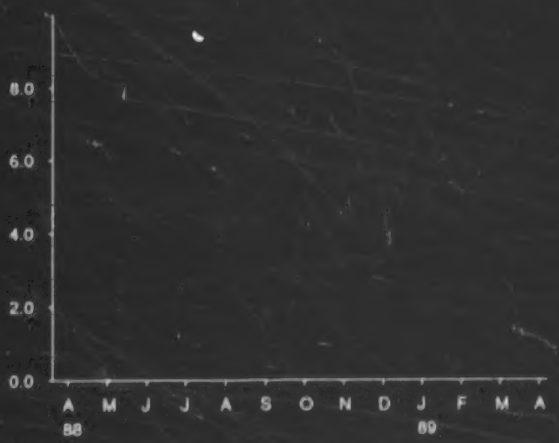
SEASONALLY ADJUSTED

	4/88	5/88	6/88	7/88	8/88	9/88	10/88	11/88	12/88	1/89	2/89	3/89	4/89	1986	1987	1988
Personal Income (Bil. $) 1	1413.8	1414.7	1425.0	1436.2	1438.5	3443.3	3479.6	3462.3	3480.4	3519.3	3541.1	3552.3	3543.6	3219.0	3323.9	3431.9
% Chg. from Mo. Last Year	3.94	3.82	4.06	3.89	3.81	7.68	13.42	5.79	6.43	14.27	7.70	3.87	-2.90	4.19	3.26	3.25
% Chg. Same Month Last Yr.	3.97	3.81	3.82	3.58	3.42	3.28	2.68	2.87	2.14	4.18	4.35	4.01	3.80	4.19	3.26	3.25
Civ. Lab. Force (Thou. Persons)	119.2	117.7	118.1	118.8	119.0	119.5	120.0	120.3	120.7	121.4	121.9	122.5	123.3	109.7	113.7	118.3
% Chg. from Mo. Last Year	5.26	5.24	4.16	5.20	4.12	5.16	5.14	4.04	4.06	7.19	5.06	6.07	8.12	1.92	3.66	4.08
% Chg. Same Month Last Yr.	1.81	3.88	3.96	4.11	4.02	4.28	4.35	4.25	4.41	4.57	4.82	4.97	5.20	1.92	3.66	4.08
Th. Nonag. Emp. (Current Data)	2061.9	2061.9	2066.6	2067.0	2061.5	2061.3	2069.0	2083.6	2070.7	2088.0	2087.7	2081.9	2081.1	1929.7	2011.5	2066.0
% Chg. from Mo. Last Year	1.88	1.76	1.81	2.01	1.70	1.70	4.81	8.75	7.18	10.50	10.14	3.26	0.49	3.32	4.24	2.71
% Chg. Same Month Last Yr.	0.73	0.73	0.85	0.91	1.00	1.05	1.44	1.87	0.74	1.97	1.27	0.57	0.69	3.32	4.24	2.71
Th. Manufacturing Employment	524.9	525.1	525.6	525.8	526.1	526.2	526.5	526.8	527.1	527.4	527.7	527.9	528.1	496.5	502.2	505.6
% Chg. from Mo. Last Year	5.58	5.57	5.56	5.58	5.53	5.50	5.57	4.00	3.11	3.03	3.05	1.99	2.32	2.06	2.69	3.31
% Chg. Same Month Last Yr.	3.24	3.24	3.54	3.40	3.44	3.83	3.18	3.24	3.10	3.44	3.16	3.06	3.04	2.06	2.69	3.31
Th. Construction Empl. (SA)	5.4	5.7	5.8	6.0	5.7	5.8	5.8	5.6	5.8	6.3	5.5	5.7	5.2	6.0	6.6	5.8
Unemployment Rate	5.5	5.6	5.4	5.4	5.5	5.4	5.3	5.3	5.2	5.4	5.1	5.1	5.3	7.0	6.2	5.5
Manufacturing Hours	40.3	40.4	40.3	40.4	40.4	40.5	40.3	40.3	40.4	40.6	40.6	40.8	40.5	40.3	40.2	40.3
Th. Mfg. Prod. Worker Payrolls	126.1	126.2	126.9	126.9	126.7	126.9	127.0	127.1	127.4	127.6	127.7	127.9	128.1	118.8	122.7	126.6
% Chg. from Mo. Last Year	7.00	6.96	6.84	6.80	6.74	6.71	7.80	8.52	7.85	8.52	8.75	7.69	6.90	2.39	3.33	4.77
% Chg. Same Month Last Yr.	4.80	4.91	5.50	4.88	4.79	4.67	4.31	4.60	4.12	4.47	4.46	4.01	3.93	2.39	3.33	4.77
Th. Trade, Trans. & Public Util.	744.9	743.0	747.3	745.1	744.1	743.9	744.1	744.8	745.9	747.4	748.6	748.6	745.7	732.1	739.6	742.5
% Chg. from Mo. Last Year	3.13	3.11	3.38	3.16	3.43	3.28	3.68	3.68	3.99	3.91	4.04	3.47	3.52	2.52	2.65	2.11
% Chg. Same Month Last Yr.	1.47	1.52	1.84	1.84	1.84	1.84	1.48	1.47	1.32	1.59	1.64	1.71	1.97	2.52	2.65	2.11
Th. Wholesale & Retail Trade	723.1	721.1	724.1	723.1	723.8	723.7	723.8	724.4	725.6	726.3	726.3	726.3	726.8	715.1	719.0	723.3
% Chg. from Mo. Last Year	4.00	4.00	4.31	4.00	4.01	3.92	4.29	4.59	4.20	4.46	4.83	4.05	4.70	3.13	3.39	3.64
% Chg. Same Month Last Yr.	4.29	4.28	3.42	3.34	3.26	3.19	3.21	3.86	3.84	3.84	3.85	3.72	3.69	3.13	3.39	3.64
Th. Wholesale Trade	114.1	113.8	114.1	113.9	113.9	114.1	113.6	114.1	114.2	114.2	114.7	114.2	115.1	110.7	113.0	113.8
% Chg. from Mo. Last Year	2.55	2.80	2.51	2.57	2.59	2.51	2.52	2.39	1.08	0.89	0.66	0.40	0.91	2.78	2.09	0.69
% Chg. Same Month Last Yr.	0.88	0.92	1.11	0.96	0.88	0.88	0.24	1.67	1.27	1.61	0.79	0.42	0.96	2.78	2.09	0.69
Th. Finance, Ins. & Real Est.	2227	2237	2250	2240	2254	2277	2300	2331	2358	2350	2365	2349	2321	24319	25118	26788
% Chg. from Mo. Last Year	10.21	10.47	8.21	10.21	9.84	9.71	10.78	10.88	11.28	11.03	9.28	8.10	7.89	4.10	3.67	6.65
% Chg. Same Month Last Yr.	8.17	8.47	8.49	7.68	7.84	7.81	7.81	7.78	7.78	7.75	7.72	7.78	8.37	3.67	3.29	6.65
Th. Agriculture, Forest, Fishing & Mining	144	140	141	141	140	141	155	154	149	146	138	142	155	125	143	144
% Chg. from Mo. Last Year	71.94	41.94	48.41	8.19	28.80	56.21	30.19	82.67	9.33	155.99	49.15	40.90	186.10	16.80	13.91	0.93
% Chg. Same Month Last Yr.	5.41	4.23	4.44	0.00	4.48	2.17	3.33	6.20	0.74	5.04	1.47	4.70	0.64	16.80	13.91	0.93
Th. Mfg. Employment	507.7	507.9	507.4	507.4	507.8	508.0	508.4	508.8	510.0	510.6	511.2	511.8	511.4	510.9	490.5	497.5	508.2
% Chg. from Mo. Last Year	1.00	1.00	0.91	0.95	0.88	0.87	1.02	0.97	0.79	1.05	0.87	1.09	0.79	1.41	2.16	
% Chg. Same Month Last Yr.	1.24	1.24	1.20	1.14	1.22	0.77	0.53	0.60	0.48	0.49	0.58	0.67	0.79	1.41	2.16	
Mfg. Hours (Current)	39.0	39.2	39.4	39.4	39.4	39.5	39.6	39.6	39.6	39.8	39.7	39.7	39.7	39.0	39.0	39.4
% Chg. from Mo. Last Year	1.30	1.65	1.80	1.81	1.81	0.47	4.47	3.25	1.98	2.67	0.00	1.97	0.67	1.54	0.31	1.99
% Chg. Same Month Last Yr.	1.30	1.75	1.84	1.81	1.81	1.81	1.81	1.82	1.54	1.94	2.04	1.71	1.54	1.54	0.31	1.99
Th. Mfg. Prod. Worker Employment	41.7	41.5	41.7	41.6	41.7	41.8	41.7	41.6	41.7	41.7	41.8	41.7	41.7	41.2	41.6	41.6
% Chg. from Mo. Last Year	5.76	5.78	5.61	5.74	5.62	5.40	4.63	3.88	3.38	3.69	3.73	3.07	3.26	0.68	0.80	0.06
% Chg. Same Month Last Yr.	3.70	3.80	3.96	3.84	3.96	3.96	3.71	3.71	3.38	3.74	3.73	3.72	3.67	0.68	0.80	0.06
Th. Farm Emp. (SA) Est.	1344	1311	1405	1297	1274	1374	1272	1357	1458	1341	1354	1505	1409	35351	37571	39825
% Chg. from Mo. Last Year	8.79	4.80	12.09	12.24	6.81	64.34	-45.53	-0.70	4.82	-33.40	3.78	69.84	-26.29	7.81	6.28	6.00
% Chg. Same Month Last Yr.	8.19	4.80	8.56	2.24	2.71	6.56	1.08	8.27	1.07	7.34	0.22	5.48	2.63	7.81	6.28	6.00
Th. Farm Emp. (NSA) Est.	2814	281	2881	2780	2755	2827	2677	2791	2865	2754	2761	2861	2765	32228	33035	33651
% Chg. from Mo. Last Year	-5.72	1.27	24.74	35.84	10.31	16.60	49.19	65.08	47.24	-37.87	-1.21	60.12	-33.68	5.78	2.51	1.86
% Chg. Same Month Last Yr.	4.18	2.66	4.42	0.98	1.67	1.73	1.07	3.86	1.44	2.65	4.38	0.49	2.45	5.78	2.51	1.86
Th. Farm Emp. (NSA) Est.	31.2	33.1	33.9	31.6	40.1	35.0	36.1	39.3	35.8	45.5	33.4	33.1	30.5	517.0	437.6	415.3
% Chg. from Mo. Last Year	-1.91	19.44	30.7	58.2	170.1	-80.5	62.3	176.1	94.5	462.7	-52.7	6.1	-64.6	-4.4	-15.4	-5.1
% Chg. Same Month Last Yr.	-18.0	-.46	7.47	24.35	28.35	10.31	16.22	16.80	28.02	4.05	3.08	-4.20	-2.45	-5.20	-14.35	-5.10
Ut. Ind. Prod. Index (1967=100)	150.1	89.3	144.0	154.0	207.4	164.1	174.3	202.6	147.1	177.9	165.9	169.4	159.8	2304.1	2062.4	2068.2
% Chg. from Mo. Last Year	74.8	-.22	3.1	46.2	3673.3	-94.0	106.9	506.9	197.9	876.1	56.4	28.0	50.1	-3.8	-10.5	0.3
% Chg. Same Month Last Yr.	1.40	-.54	-11.56	-11.56	20.22	-4.47	11.23	22.56	-11.42	6.32	-5.49	-5.00	0.64	-3.79	-10.49	0.28
Total Th. Investment in Plants &	443.8	442.1	440.8	439.8	460.1	446.7	423.7	483.6	432.4	434.9	479.9	404.5	552.0	5259.6	5324.6	5279.3
% Chg. from Mo. Last Year	-61.4	72.1	92.4	97.5	437.8	-29.6	-47.0	389.0	-73.9	7.0	225.7	-87.1	4376.6	-11.4	1.2	-0.9
% Chg. Same Month Last Yr.	3.91	2.19	1.05	21.24	36.57	3.34	4.61	16.07	2.20	32.90	9.21	-13.48	24.38	-12.38	1.23	-0.86
Th. Farm Emp. (NSA) Est.	196	414	187	441	881	925	396	295	338	281	258	284	379	4168	4496	4168
% Chg. from Mo. Last Year	317.8	767.2	126.1	870.7	581.1	98.5	922.1	96.4	472.1	89.1	95.2	2249.1	3069.5	7.9	7.9	-5.1
% Chg. Same Month Last Yr.	-2.10	3.01	25.00	1.20	2.80	11.39	11.40	-2.36	16.34	44.32	-17.56	16.00	-1.99	1.94	7.86	-5.07

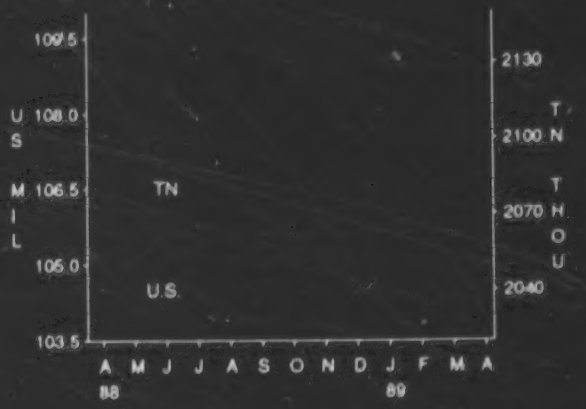
	88:I	88:II	88:III	88:IV	89:I	89:II	89:III	89:IV	88:I	88:II	88:III	88:IV	89:I	1986	1987	1988
GNP, Bil. $, SA	3714.1	3717.4	3721.3	3734.7	3778.7	3823.0	3865.3	3923.0	3956.1	3985.2	4009.4	4033.4	4076.5	3721.7	3847.0	3996.0
% Chg. from Qtr. Last Year	6.96	6.81	7.00	7.49	6.57	6.99	6.50	6.51	5.42	2.07	2.45	2.42	4.34	2.85	3.37	3.87
% Chg. Same Qtr. Last Yr.	3.38	3.72	3.35	3.97	1.56	3.00	3.87	5.08	4.75	4.24	3.73	2.81	3.04	2.85	3.37	3.87
Th. Personal Income (Bil. $)	56777	56956	57087	57297	60651	61615	62846	64977	64946	66465	67903	69419	NA	57550	62522	67183
% Chg. from Qtr. Last Year	8.58	8.64	8.74	8.39	11.11	8.51	8.23	14.27	10.19	9.69	8.04	9.22	NA	7.30	8.64	7.45
% Chg. Same Qtr. Last Yr.	7.12	6.87	8.07	7.18	7.96	8.16	8.20	10.15	7.08	7.87	8.05	6.84	NA	7.30	8.64	7.45
Th. Personal Income (Mil. $) 5	49539	50147	50637	50983	51706	51821	52285	53479	53141	53644	54238	54790	NA	50324	52423	53954
% Chg. from Qtr. Last Year	7.41	6.94	6.05	5.76	5.80	5.89	5.63	9.46	7.46	7.79	6.48	6.15	NA	4.74	3.97	3.12
% Chg. Same Qtr. Last Yr.	4.09	4.54	5.42	4.73	4.37	3.36	3.25	4.90	2.79	3.52	3.73	2.45	NA	4.74	3.97	3.12

Annual Rate.
Calculated from data provided by the Tennessee Department of Employment Security.
Source: Tennessee Valley Authority.
Source: The Conference Board.
Calculated from sales tax collections, provided by the Tennessee Department of Revenue.
Source: F.W. Dodge Division of McGraw-Hill Information Services Company.

Percent Change in the U.S.
Consumer Price Index
Seasonally Adjusted

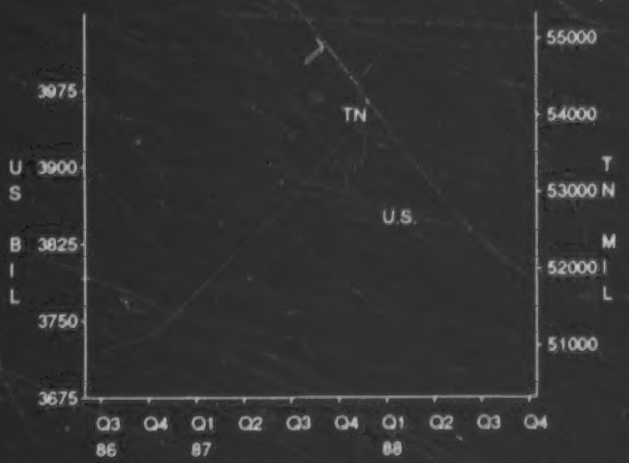


Total Nonagricultural Employment
Seasonally Adjusted

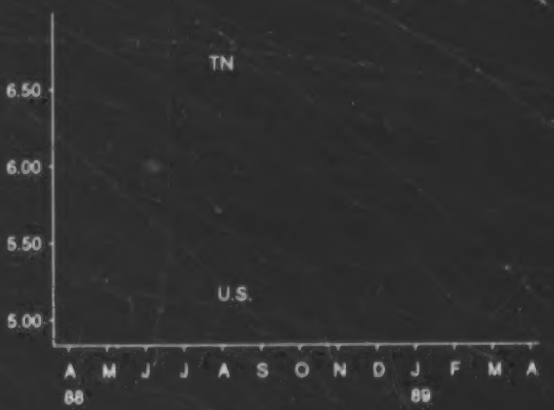


Note: Calculated from data provided by the Tennessee Department of Employment Security.

Real Personal Income
Seasonally Adjusted Annual Rate
1982 Dollars



Civilian Unemployment Rates
Seasonally Adjusted



Note: Calculated from data provided by the Tennessee Department of Employment Security.

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